



FRIDAY, DECEMBER 30.

NEWS OF THE WEEK.

We give below, in a condensed form, the leading news items of the week. These items will be found in detail in their appropriate columns.

Meetings Next Week.—Cleveland & Pittsburgh.

Personal.—Died, John F. Anderson.

Elections.—Mobile & Ohio, James C. Clark, General Manager.—Rhode Island Commission, James H. Anderson, Commissioner.

New Companies Organized.—Austin & McGregor files articles in Texas.—Evansville, Suburban & Newburg is incorporated in Indiana.—Galveston & Western is chartered in Texas.—Indianapolis, Decatur & Western files articles in Illinois.—Long Beach, Whittier & Los Angeles files articles in California.—Pacific Railway files articles in Nebraska.—Panhandle is chartered in Texas.—Romney & Short Mountain is chartered in West Virginia.

Changes and Extensions.—Georgia: Northeastern will extend road to Knoxville, Tenn. Kansas: Kansas City & Southwestern is completed from Kansas City, Mo., to Paola. St. Louis & San Francisco completed to Ellsworth. Michigan: Toledo, Ann Arbor & Cadillac is completed from Mount Pleasant to Cadillac. Nebraska: Pacific completes line from Warwick, Kan., to Lawrence. New Hampshire: Upper Coos completed from North Stratford to West Stewartstown.

Traffic.—Anthracite coal shipments for the week ending Dec. 24 show an increase of 16.7 per cent., as compared with the same period last year; bituminous shipments show an increase of 41.4 per cent. Cotton receipts, interior markets, for the week ending Dec. 23 show an increase of 21.9 per cent., as compared with the corresponding week last year; shipments show an increase of 14.7 per cent.; seaport receipts show an increase of 28.3 per cent.; exports an increase of 1.9 per cent.; cotton in sight is greater than at the same date last year by 3.2 per cent.

Earnings.—Seven roads report gross and net earnings for the month of November, 1 showing a decrease in net; 10 roads report gross earnings for November, 7 showing an increase and 3 a decrease; 5 roads report gross and net earnings for the eleven months ending Nov. 30, all reporting an increase. For the year to Sept. 30, 21 roads report gross and net earnings, 4 reporting a decrease in gross and 5 a decrease in net. The net increase is \$5,504,224, or 10.9 per cent.

Miscellaneous.—Strike on the Philadelphia & Reading has failed.

Contributions.

Tractive Power and Train Resistance.

CHICAGO, Dec. 25, 1887.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of Nov. 25 you gave credit of a hauling capacity to the six wheeled connected Schenectady locomotive, built for the Colorado Midland, of 249.5 tons, less weight of locomotive and tender—99 tons—equaling 150.3 tons. It is trusted that you will permit indulgence in making an inquiry whether you have inadvertently overlooked several important factors in an effort to arrive at the hauling capacity of a locomotive having a given weight on the drivers.

Leaving out of question tractive power, which is, or should be, calculated with especial concern to the one great element, adhesive force, you have employed a co-efficient based upon results of tractive power instead of a well known co-efficient to ascertain the adhesive force of a locomotive. However, no fault can be found with the co-efficient used, it being 4.4, and within the range of 4½ and 4¾.

It is the method of arriving at such a conclusion and not the accidentally correct results that is questionable.

Regarding the resistance per ton of 2,000 lbs. of load you gave due credit of 80 lbs to the 210 ft. grade and 10 lbs. on account of friction, but omitted that due to both curves and speed, which, for a 16 degree curve and a probable speed to be attained on that line, cannot be less than 15 lbs. per ton of load, a very liberal estimate.

Now, the reader of a journal of a standing of such excellence as that of the *Gazette* is somewhat misled by only casually glancing at such data, and therefore it seems almost culpable to permit their issuance crediting the Colorado Midland locomotive with 22,440 lbs. adhesive force obtained. By using your co-efficient, 4.4, the hauling capacity cannot be greater than 213.7 tons, 99 tons for locomotive and tender, 114.7 tons; or, employing 4¾ for a co-efficient resulting in a credit of an adhesive force of 23,294 lbs., the capacity cannot be greater than 221.8 tons, less the 99 tons, giving a tonnage capacity of only 122.8 tons.

The total resistance due to grade, curves, friction and speed is 105 lbs. per ton of 2,000 lbs. of load, and it is not safe or prudent to base calculations upon utilizing a lower co-efficient than 4¾ for ascertaining the adhesion of locomotives to be operated in the section through which the Colorado Midland extends its sinuous way.

D. C. S.

The Milford Haven Route.

GAINES, WORCESTER, England.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I was very pleased to note your article and sketch map on the subject of the Milford Route. I have been agitating the question for years. But you do not state the whole case.

A passenger from London leaves Queenstown on Sunday midday by Cunarder, and in little over six days he is in New York. But to get to Queenstown the passenger from London needs to leave Friday afternoon, sleep in Liverpool and get on board the Cunarder Saturday midday, arriving at Queenstown Sunday morning—two days of traveling that takes more out of you than the six across the ocean.

Now, if the Cunarder called at Milford in place of Queens-town the mails and passengers could leave London Sunday morning by fast special train and be on board early on Sunday afternoon.

But then arises the question of the mails.

At present they leave London Saturday night; at Holy-head they are transhipped to a steamer at Kingstown; again transhipped on trolleys; then transhipped on railway cars; at Dublin transhipped on trolleys across the town by horses; then transhipped to railway cars; at Queenstown transhipped to the tug-boat and finally transhipped on the Cunarder.

I question if the English government, in view of the Irish row that would arise, would permit the post-office to change the route from Queenstown to Milford.

Some few years back I talked the matter over with the Cunard people. They had not an argument against the Milford Route, but finally closed it by saying it will come to it some day, but not yet awhile.

Milford will not do as the ultimate port, because the freight is wanted at Liverpool, not Milford, but the Cunarder could call just as well at Milford as at Queenstown.

W. A. ADAMS.

The Chicago, Burlington & Northern Examinations.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have been much interested in reading the questions used on the Chicago, Burlington & Northern,* published in your paper recently, and am glad to see a determined move in this direction. I have found in my own experience that it is always necessary to pump a man thoroughly before I can feel sure that he understands what I order him to do, and I have lately talked with a general superintendent who says his experience is the same. But from what little questioning I have done it seems to me that these you publish are very inadequate and only partly fill the bill; in fact you really admit as much in your editorial on the subject, though, strangely enough, you praise them as if they were well-nigh perfect.

*** Many of those questions are too simple; the answer is apparent to any trainman of three weeks' experience. One is reminded of the first page of a primer. It is all well enough to start off with first principles, but to make men work up a real active interest in the business they should be asked hard questions, or at least some which would require a somewhat extended process of reasoning to give a comprehensive answer. We can learn much from a common school-book, an arithmetic, for example. The most instructive questions are often those which seem to encourage an erroneous answer. If a man stumbles a few times it makes him more circumspect in his future steps.

I have been interested to know how these inquiries are conducted; it must be that the questioners have to ask other questions than those published. What do they do when a man gives a wrong answer? I am so unfortunate as to be on a poor road, which cannot afford the expense of such a plan as I would like to put in effect. I try to do what questioning I can, but I have to attend to it personally, and with other duties pressing I have to slight it, and almost always have to dismiss men before I have really got through with them, a proper hearing takes so long. Why, it takes a man an hour, more or less, to simply read the rules and take in each sentence carefully; and on many of the rules one could ask a dozen questions. It is easy to see that no man can properly inspect the large number of men usually placed under the charge of a single officer unless he give his whole time to it. But while unable to do what I wish myself, I am interested to see some road that has a more extensive staff do more in this direction. It would be interesting to hear more from the Chicago, Burlington & Northern officers. Superintendents would like to know how they like the plan, whether their satisfaction with it is enthusiastic or only lukewarm.

Referring now to question 3, for instance (if these questions are for brakemen), why should it not say, "When you are on the forward part of a train that has broken apart, what are you to do to get your train together again?" Then, if he had any inclination to act heedlessly or without authority, he would probably betray it. Question 4 seems to be absolutely useless. It would take a whole page of questions to find out whether a man really could tell the qualifications necessary for an efficient local freight conductor. The answer to question 11 is a sort of cut-and-dried affair. No two men would answer that comprehensive question exactly alike; why not let them give original answers? Also, put the question in other forms, as, "If weather is stormy or foggy, how much further must you go than under other circumstances?" Ask what trains should be flagged against the most carefully (to see if he will promptly answer that all are

*Questions used in the examination of train men and telegraph operators to ascertain if they correctly understand the train rules.—*Railroad Gazette*, Dec. 9, p. 793.

to be treated alike, or rather that the flagging is to be done even if it is almost certain that no train is behind). Ask when it is proper to flag without using torpedoes. Ask why it is necessary for the flagman of a passenger train always to "alight with signals as soon as train stops." Where right reasons cannot be given, impress the fact that some things must be done even if the reason is not fully discernible.

Question 22 is an important one on the road I am connected with. The rules are explicit enough, but trainmen persist in doing as they individually think best. A man answering that trains must "proceed cautiously, expecting to find the main track occupied," may be the most slippery fellow in the lot. I cannot see any way to properly examine men on this rule, except to take individual cases of certain trains and certain stations and make them tell how they would act. This would take much time and labor, but I believe it pays.

Question 13 under telegraphic orders is of a kind that there should be more of; the telegraphic questions in general seem to be more ingeniously prepared than the others. The questioner must assume ignorance to get best results.

Questions 16, 17 and 18 to operators touches an important point. I find that the best way to cover this is to question operators concerning their own respective localities; ask them as to their experience; if they ever had a light go out; where they keep their spare red light, and how often they fill it; where they hang or set it when it is used; what accidental circumstances have arisen to obscure the view of it from the office, etc. But I trespass on your space; this is an important matter and superintendents and train masters who have to spend much time and anxious thought on it need to advise each other in reference to it. What better subject could be taken up by the Superintendents' Association?

KENTUCKY.

Continuous Steam Heating.

TO THE EDITOR OF THE RAILROAD GAZETTE:

Continuous steam heating is doubtless a great improvement on the old fashioned stove, but the details require much improvement. I traveled up from Buffalo by the New York Central a few days ago on one of their swagger trains. A few miles out of Buffalo the heater hose coupling between the two last cars blew off. Fire had to be kindled in the Baker heater, but it was some time before the car was warm. Later on, the hose between the tender and first car blew off, and the whole train was without steam, and uncomfortably cold. Success cannot be expected at the first effort, and it is evident that a stronger method of fastening the hose and the use of a lower pressure of steam are very desirable if continuous steam heating is to be a success.

A. REISSINGSEN.

Guard Rails for Bridges—Circular from the Massachusetts Commissioners.

The following circular has been issued by the Massachusetts Board of Railroad Commissioners to the railroad companies of the state. It is dated Dec. 20, 1887.

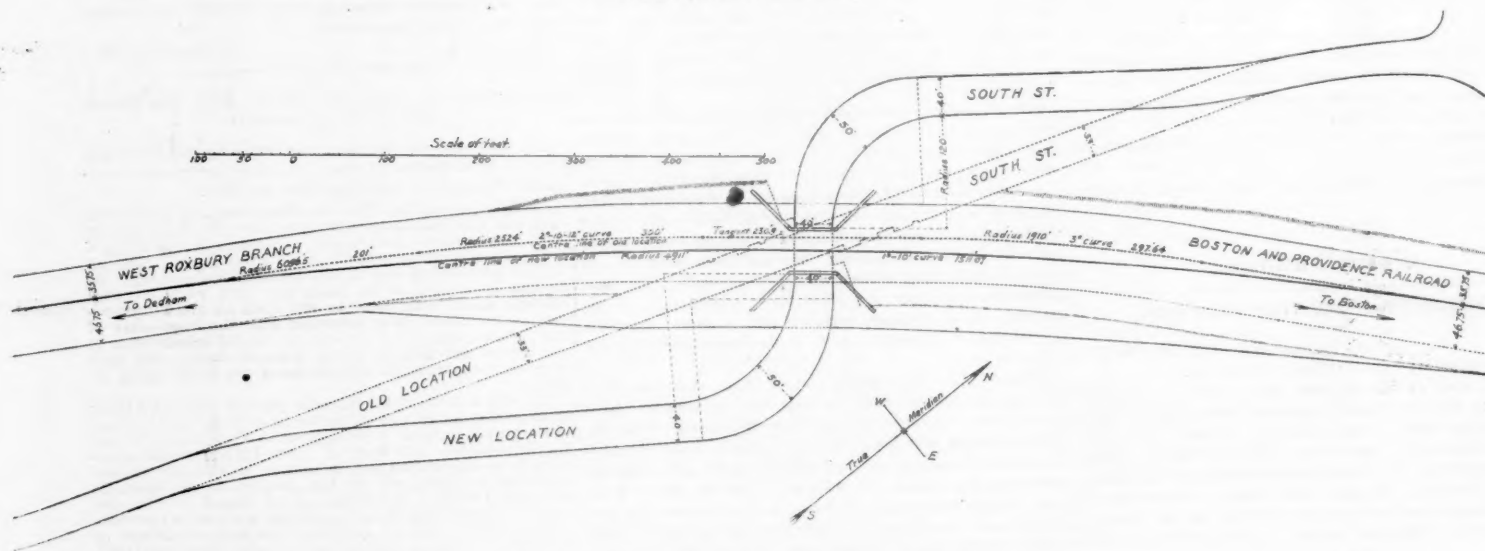
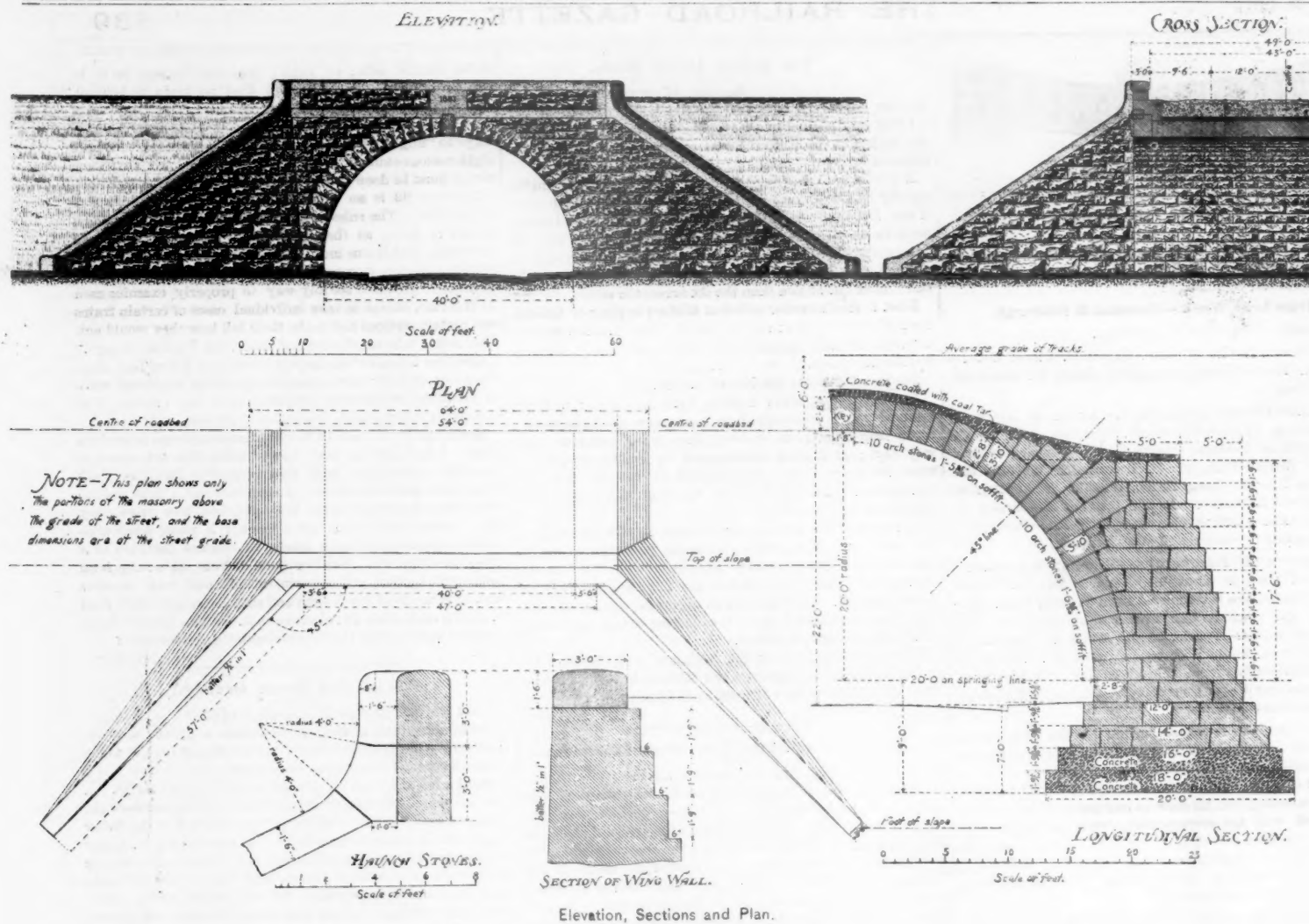
In their report for 1881, the Board recommended to the railroads of the Commonwealth a consideration of the various forms of guard rails for bridges, with the hope of securing a more extensive use of some form of safety guard. Though much has since been done in this direction, and although the bridges of several of the roads are well provided with efficient guard rails, there is still room for much improvement. The Board are so impressed with the importance of this subject, that they have given careful consideration to the merits and defects of the different forms, and they urgently recommend the general use of the form herein described.

The object of the guard rail is to prevent a derailed truck from getting far enough off the track to strike any portion of the girder, or from becoming twisted so as to lead to further derailment. The floor of every bridge should, moreover, be so constructed as to be able to carry safely any derailed car or engine; and for this purpose the ties should be substantial timbers, measuring not less than 6 by 8 in., and spaced not more than 8, and preferably 4 or 6 in. in the clear. Efficient guard timbers outside of the rails should also be provided, notched on each tie and bolted at short intervals—the object of such timber being to hold the ties in place, and to keep them from being bunched by a derailed wheel. Instead of notching the guard timber over the ties, it may be simply bolted, and spacing blocks securely fastened between the ties to keep them apart.

In addition to such guard timbers, guard rails are requisite, so arranged as to bring a derailed truck nearly back to its proper position, and guide it across the bridge without allowing it to deviate more than a few inches from the rails. For this purpose, outside guard rails and inside guard rails are in common use. The ordinary arrangement of outside guard rails is as follows: The guard timbers before described are placed six or eight inches from the rails, and are sometimes protected with an angle iron fastened to the corner. At the ends of the bridge, or on each track at the end at which trains enter upon the bridge, curved rails extend from these guard timbers, flaring outward and resting on long ties.

The Board recommend the use of the inside guard rail, placed with a clear space of from 7 to 10 in. between the heads of the guard rail and the track rail, securely spiked to the ties, and with ends running to a point in the centre of the track on the side from which trains approach. The distance of this point from the end of the bridge should vary in different cases, but should not be less than 30 ft., and preferably 60 ft. on important bridges. If the approach is on a curve, the guard rail should be carried farther; and on sharp and short curves it is advisable to extend them entirely around the curve, or to run them to a point 30 or 60 ft. from the bridge, and from this point to carry a single rail in the centre of the track around the curve. The point of the guard rail should be protected by an old frog point or by a beveled wooden block to prevent any hanging chain from catching on the end. The distance between the track and the guard rails should be sufficient to allow a wheel to run between them without crowding either rail, or from 7 to 10 in.

The Board consider that this form of guard rail is much more efficient than the outside guard rail in bringing a derailed truck back to its proper position. On many roads, the outside guard rails extend but a short distance beyond the ends of the bridge, and are frequently curved abruptly so as to be nearly at right angles with the track. Furthermore, the long ties on which such guard rails rest are generally insufficiently bedded in the ballast outside of the rails,



Plan of Crossing, West Roxbury Branch, over South Street.

SOUTH STREET BRIDGE, BOSTON & PROVIDENCE RAILROAD, WEST ROXBURY, MASS.
(REPLACING THE SO-CALLED "BUSSEY BRIDGE.")

S. L. MINOT, Engineer.

The tendency of such a guard rail is to stop the wheel which strikes it and to twist the truck still farther, placing it at a greater angle with the track, and thus tending to increase rather than to diminish the danger of an accident. The Board consider such guard rails to be worse than useless and recommend that they be replaced by inside guard rails without delay. Outside guard rails of proper length, slightly curved and properly laid, may accomplish their intended purpose, but they are wrong in principle, because they are struck by the wheel at the wrong end of the axle, and if they do their work at all they do it at a great disadvantage. The objection is sometimes urged against inside guard rails that a mischievous person may place an obstruction between the guard and track rails, or that some obstruction may accidentally get there. The Board believe that this argument has no practical weight, and that even if a truck were derailed in this manner, it would by virtue of the guard rail pass safely across the bridge. A person who desires to wreck a train can find abundant means of doing it more effectual than this. Further objections are sometimes pleaded that the use of the snow-plow is rendered difficult, or that a hanging chain may catch on the point of the guard rail. These also appear to the Board to have little weight. The points may be protected as already explained, and the use of the snow-plow is no more interfered with than at any turnout or crossing. Finally, it is sometimes urged that a truck, if derailed far enough to get on the wrong side of the point, would be still further deviated by the guard rail. As long as a train holds together, it is very rare for a truck to be off the track for more than a few inches or a foot. If a train has parted and a truck is off by as much as one-half of the gauge, the wheels

on one side of this truck would be off the ties and a smash-up could hardly be averted, no matter what shape of a guard rail were applied. Certainly the ordinary form of outside guard rail would do no good. Furthermore, the possibility of such an accident at a bridge may be almost completely removed by extending either the guard rails or a single guard rail on curved approaches, as has been suggested. Other devices are in use which have for their object not only to safely guide a derailed truck, but to replace it upon the rails. Some of these devices, if properly applied, appear to the Board to have great merit, and they do not desire to be understood as withholding their approval from them.

Stone Arch Bridge over South Street, Boston & Providence Railroad.

This bridge, now about completed, will replace the Bussey bridge, destroyed last March.

Those familiar with the former structure may remember that the bridge was built upon a considerable skew, the angle between the line of the railroad and that of the street being about 21°. As the construction of a stone arch at this angle would offer some objectionable features, as well as being much more expensive on account of the greater span, it was decided to change the location of the street in the vicinity of the bridge, carrying it under the railroad at an angle of 90° thereto, thus reducing the span of the arch to 40 ft., the

width of the new street. In order to accomplish this, it became necessary to change the course of the roadway for some distance from the bridge, locating it for a distance of from 300 to 400 ft. on either side, nearly parallel to the line of the railroad, and from 150 to 200 ft. distant from the centre thereof, and joining these portions with the opening of the arch by curved approaches, having a minimum radius of 120 ft. upon the inner side.

In addition the street has been widened from 38 ft. to not less than 40 ft. throughout the new portion, and 50 ft. at the middle of each of the approach curves. Sidewalks (before wanting) have been built, a sewer put in, and curbstones laid under the arch, the whole of the work having been done by and at the expense of the railroad corporation. Notwithstanding the somewhat greater length and less direct course of the highway due to the change, it is believed that the light pleasure teams, which constitute the greater part of the travel over the street, will be benefited by the change, as the street is for 300 ft. nearly at right angles to the railroad.

In connection with this change, it was decided to shift the centre line of the location of the railroad about 15 ft. to the east and nearer the road, and to substitute a simple curve of 1° 10' curvature for the curves of 2° to 3°, united by a tangent of about 230 ft. across the bridge which formerly existed. At the same time the embankment will be widened



Fig. 1.

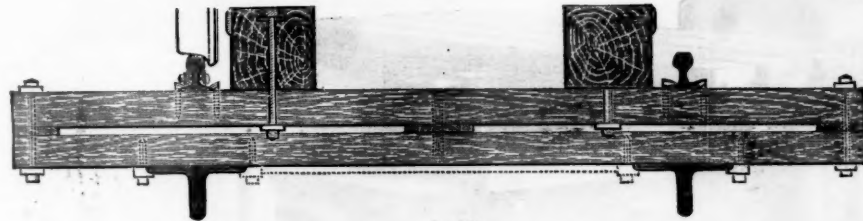


Fig. 2.

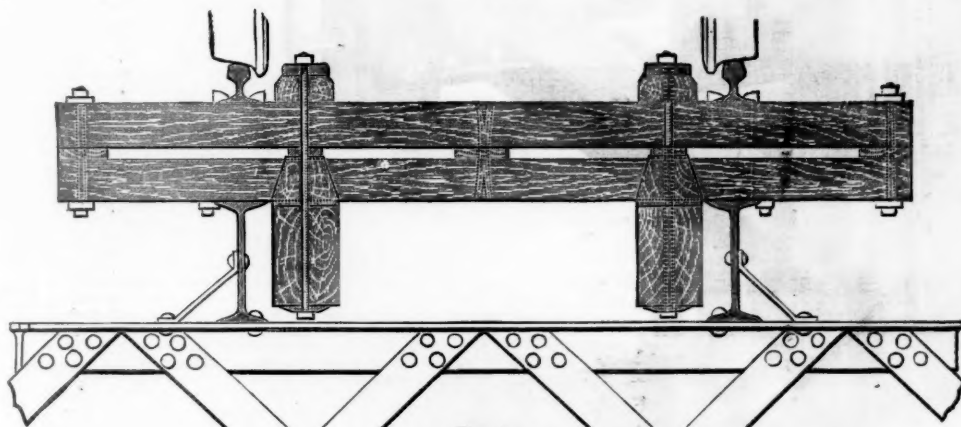


Fig. 3

WOOLSON'S COMPOUND TIE AND BRIDGE FLOOR.

sufficiently to accommodate three tracks, 12 ft. apart on centres, with a liberal berm on the outside.

The bridge itself is an approximately full centre arch of 40 ft. clear span and 22 ft. clear height, the springing line being about 2 ft. above the grade of the roadway, and the curve of the arch being carried down to grade. The wing walls are set at an angle of 45°, with the vertical faces of the arch and batter $\frac{1}{2}$ in. to the foot, the faces of the ring and spandrels being plumb. The face or end stones of the arch show from 18 to 20 in. in thickness and 3 to 4 ft. in length, and their outer ends are dressed to horizontal and vertical joints, stepping up from the haunches to the crown. The faces of the spandrels and wing walls are of uncoursed squared cut stones of various sizes, locally termed "broken ashlar." These stones, together with the arch stones, have a projecting quarry face, the arch stones having a chisel draught of $1\frac{1}{2}$ in. cut upon all edges of face and soffit, while the "broken ashlar" is merely pitched to line.

A parapet projects above the grade of the track to the height of 3 ft. upon either side, and this, as well as the wing walls, is capped by a line of coping stones, 3 ft. wide by 18 in. deep, having all exposed surfaces fine pointed, and the upper surface worked off to an approximately elliptical curve. The coping of the wing walls is terminated at its upper end, and joined to that of the parapet, by a curved haunch-stone, and at its lower end by a toe-block united to it by an easy curve. Dimension quoins, with a chisel draught on all edges, unite the wing walls with the face.

The arch stones, quoins, belt course and copings are all of a sienitic granite, of a light red or pinkish color, from North Conway, N. H. The faces of the spandrels and wing walls are of a light blue or gray granite from Biddeford, Maine. The contrast between the two colors is pleasing but not too prominent.

Internally the arch stones form a ring, generally 32 in. in thickness, but having throughout the lower two-thirds of its height upon either side headers projecting about a foot into the backing, and binding the arch ring thereto. These headers occur in every alternate course as high as the backing is carried, and alternate with the stretchers in the courses in which they are placed.

The ring stones are cut, bed and build, over the full depth of the stretchers to lay to a half-in. joint. The backing and foundation stones are laid in courses of approximately equal height, and are split or dressed to lay to one in. joints, and well bonded.

The foundation is carried to a depth of 7 ft. below street grade over the greater portion of its extent, and its lower half is of English Portland cement concrete upon a hard pan bottom, the width of the foundation at the base being 20 ft., or one-half the span of the arch.

All of the face stones are laid in English Portland cement, mixed with two parts of sand, and are pointed with Alsen & Sons' German Portland cement, mixed in the same proportions. The backing is laid in Rosendale cement. The upper surface of the masonry of the arch ring and backing is cov-

ered with a layer of Portland cement concrete, having a minimum thickness of about six inches, and coated with coal tar.

Work on the arch was commenced early in August of this year, and the easterly half of its width completed in October, the trains being carried upon the trestle, which was built at the time the former bridge was destroyed. Upon the completion of the first portion, the track was supported by temporary wooden trusses of about 35 ft. span, resting upon wooden bents, which foot upon the haunches of the arch, while the second part was being built.

Owing to the unusually mild weather which prevailed up to the date of laying the last stone, Dec. 14, the work has suffered but slight interruption. In the few days when the thermometer has been below the freezing point the water and sand have been heated and salt mixed with the cement.

The bridge, and also the improvement of the railroad and street connected therewith, were designed and superintended by Samuel L. Minot, C. E., engineer of the railroad, who has been assisted in working out the details of the arch and in the preparation of drawings by Edward S. Shaw, C. E., and in the inspection of the masonry by Gilbert Hodger, C. E. The work has been done, under contract, by Joseph Ross and Frank H. Blaisdell.

A Railroad Bed for Bridge Structures.

Under this title Mr. O. C. Woolson called the attention of the members of the American Society of Mechanical Engineers, at their late Philadelphia meeting, to an elastic floor system designed by him and tried on a short section of the Elevated roads of New York. We reproduce some of his illustrations and give a brief abstract of his paper.

He quotes some of Holley's propositions as to the proper functions of ballast as follows:

"The ballast has four distinct offices to perform. It must, first of all, distribute the bearing of the track over the surface of the earthwork, * * * and lastly it must, by its character, give a certain elasticity to the road. * * * Very hard materials do not meet the last-named condition of an elastic absorbent. * * * Firmness without rigidity is the great requisite. The best railways in the world—those which do the most business at the least cost—are the best ballasted. If we desire to have a uniform elastic track, we may rest assured that we shall never derive the required quality from the road-bed, but only from a uniform elastic medium, interposed between a perfectly rigid foundation and the rail. Therefore, perfect rigidity of foundation—or 'superstructure'—is not only unobjectionable, but it is a positive condition of a smooth and permanent way." These quotations are directly to the point at issue. My problem was to design a "uniform elastic track," which should be "firm without rigidity," and I willingly leave it to the judgment of this practical body whether I have not succeeded.

Fig. 1 represents a cross-section of a single track road-bed on the New York Elevated. It will be noticed that instead of the tie being made of one stick it is made of two, one stick directly over the other and separated from it about 1 in., and having no contact except at the middle and the extreme ends; at these points a hard-wood block, cut from the same material as the tie, is put in, and a bolt runs through the end ones, while the middle one has simply a dowel which

binds the two sticks together and forms a compound tie. This bolting and dowering is all done before the ties are delivered to the superstructure.

The members of this flexible tie were originally 4 x 6 in., but the practice now approves 4 x 8 in. or 5 x 7 in. The spacing has no practical influence within any probable variation. The guard rails (they act as beams in my system, and will therefore be called beams), or rather guard beams, are 6 x 9 in. and 6 x 7 respectively.

It will be observed that the bolt which goes down through guard beam does not go through the lower member of the tie, but is screwed into a plate nut within the slot or space between the lower and upper member. The head of this bolt is within a thin cast-iron cup washer driven into the beam while covered with hot asphaltum. No cement is used, thus permitting the bolts to be always accessible.

The tie is fastened to the chord of the truss by $\frac{1}{2}$ -in. lag screws and clips, but it will be readily seen that this fastening to the truss has no relation to the guard beams. It is my practice to put in four $\frac{1}{2}$ -in. bolts for the guard beams, for one of the specific requirements of the guard beam in any case is to knit the whole top of the superstructure together in the most thorough manner possible.

In laying a section of this flexible or compound tie, as with the old tie, it is contract work, and is to proceed right along without delay. First the ties are distributed carefully along the top of the girders ready for the first gang, who proceeded to space off. This gang, however, pay no attention whatever as to how the guard beam is to come on, but simply place their ties equidistant and so that the clips can come on at the bottom. Therefore there is no calculation necessary; the man simply scribbles for his clip, turns over and bores the hole, and the tie is ready to be fastened to its place, and is not to come up again. This can be called straight forward work. Following comes the rail gang, but there is no leveler necessary, and not an adze is to be used, and for this reason: Although there will be found unequal heights of ties before the guard beams are put in place, the moment these beams are bolted to the upper member of the tie it immediately brings the low ties up snug to the under side of the guard beam and there is no getting away from it. The result is, that it gives as level a rail-bed as the guard beam is straight, which in the combined result of four guards, is as level as a floor, and this result is obtained without cutting a gash in the sticks anywhere. One thing yet remains to be done, and that is, one blow must now be given each rail spike to see that every one is home, because some of the ties have been pulled up to the guard since rails were laid.

To proceed now to analyze the working of the flexible road. In the first place, every bolt is under a proper strain and doing its work as designed. There are no ties suspended midway between guard beam and truss. The load of a passing train, instead of being received upon a solid stick and its weight transmitted directly to the superstructure at that immediate point, is received upon a yielding stick which springs down a little (about $\frac{1}{8}$ in.), thus bringing a certain amount of its load to bear upon a contiguous tie, by reason of the flexing of the guard beam to which the first loaded tie is bolted or hung. This flexing continues over a large area of road-bed, thus distributing the load over the same area of superstructure, and it is not necessary to argue the advantages of such distribution among engineers. Now, what is the effect of this flexible road-bed on the rolling stock? Referring back to the quotation from Holley, and we must all agree, not from this authority alone, but from every example that we ever had in this country, that all testify to the necessity for a flexible road-bed.

In September, 1879, a quarter mile section of this flexible track was put upon the New York Elevated Railroad track, and I am pleased to say that not a bolt has given out, not a spike redriven, not a tie replaced, whereas all of these have had to be done on all the lines both north and south of this section, and the rails laid on the flexible ties look as if they were good for twenty years to come. This is a most remarkable showing, but the testimony of the road master is free to all to investigate.

Fig. 2 shows a cross section of flexible road-bed with only one single heavy guard beam on a side, in which construction the guard bolt does not go through the upper member of the tie, but comes down each side of it and through a strap placed in the slot.

Fig. 3 shows an adaptation of this flexible road-bed system to a trunk line bridge. In this case the timber (used in the elevated railroad system as a guard beam) is much heavier and has no function as a guard timber, but only as a distributor of the passing load. In this case the bolts which hang the timber to the upper member of the tie go between the ties the same as in fig. 2. The thin longitudinal stringer and strap which rests upon the tie just inside the rail performs two functions, that of a strap to hang the lower timber to and that of a guard rail. The inclined portion which rests upon the distributing timber is only a block placed there to fill the space between the said timber and a longitudinal iron strap which catches the lower face of the upper member of the tie, and altogether clamps said upper member when the long through bolt is screwed up. A free space is thus left between said distributing timber and the bottom side of the lower member, and it is readily understood that both members of the tie are free to spring vertically, but in no other direction.

In closing I desire to make this statement, that with a flexible road-bed as here designed there would be a very large saving in maintenance of bridge structures, and also a higher rate of speed could be allowed with less injury to both bridge and rolling stock than with any system which I have yet seen, and the fullest criticism is solicited from practical engineers as to the proposed plan.

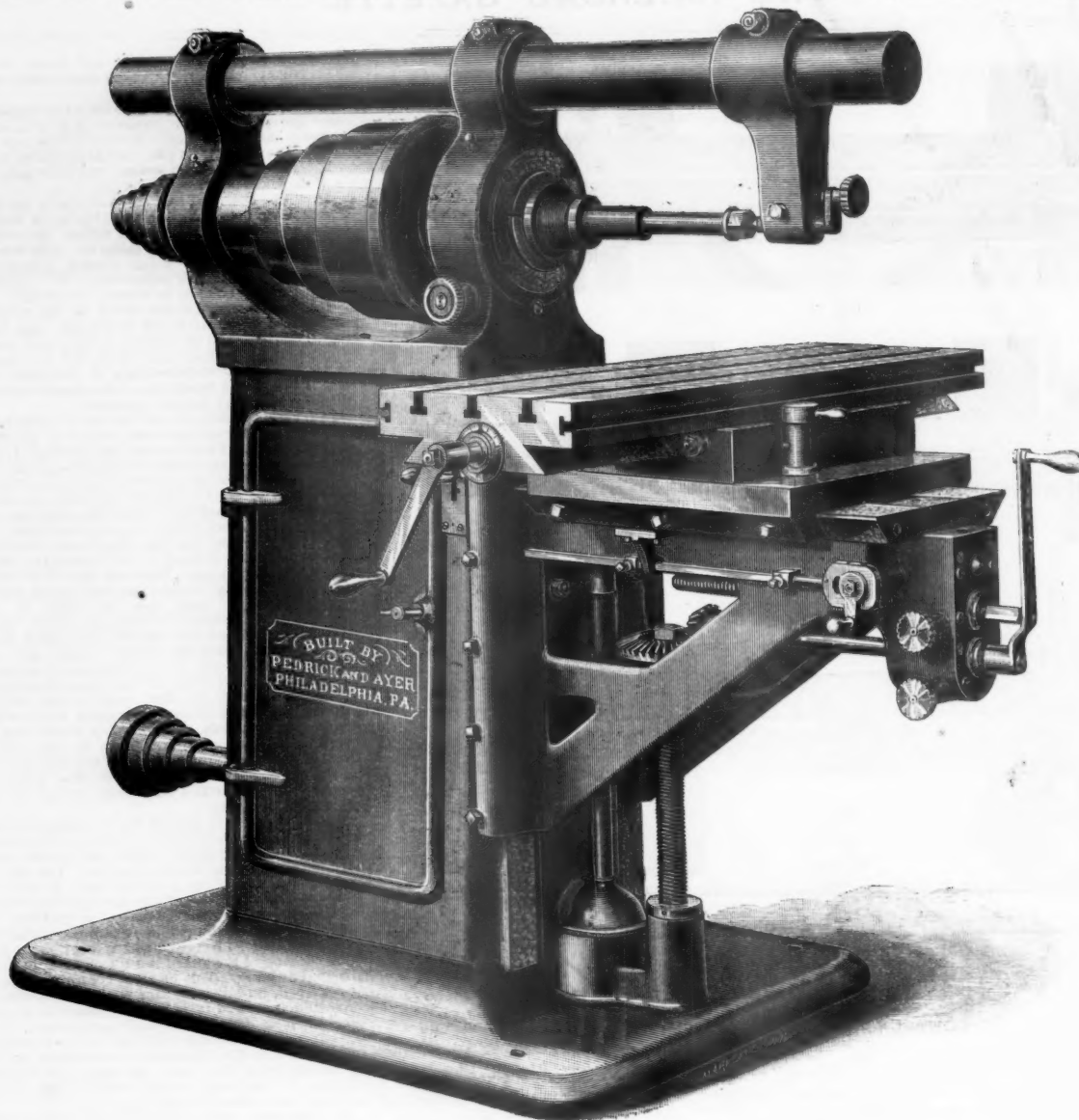
Heavy Universal Milling Machine.

The accompanying illustration represents a new pattern milling machine made by Messrs. Pedrick & Ayer, of Philadelphia, and especially intended for use in locomotive building and repair shops, where heavy milling machines are superseding planers and shapers, the latter being in many cases surpassed both in quality, quantity and range of work by strong milling machines capable of taking heavy cuts.

The machine is adapted for boring, facing, turning, milling, profiling, keyseating, splining, rack cutting, etc., and will cut gears up to 6 ft. diameter with the vertical attachment which is illustrated and described on another column.

The gearing is internal, all running parts have oil tubes, and are accessible for oiling. This machine is back-gear, 4 to 1, and is driven by a $3\frac{1}{2}$ -in. belt on a 4-step cone, of which the largest diameter is 13 in.

The spindle is of steel and runs in Atlas bronze boxes. The front bearing is $3\frac{1}{2}$ in. dia. by 6 in. long; back bearing $2\frac{1}{2}$ in. dia. by 5 in. long, and provided with easy means of adjustment for wear. The front end of the spindle is threaded on the outside for face plates or face mills. In the spindle is



HEAVY UNIVERSAL MILLING MACHINE.

Made by MESSRS. PEDRICK & AYER, Philadelphia.

a taper hole for cutter arbors 2 in. dia. at the front end, diminishing $\frac{1}{2}$ in. in 12 in. to $1\frac{1}{8}$ in. dia. through which the arbors are driven out by a rammer.

The cutter arbor supporting bar, with its adjustable centre, can be moved out to support cutter arbors 26 in. from the end of the spindle or pushed back out of the way, thus facilitating the milling or boring of a large piece of work that would be prevented by the ordinary fixed bar.

The three feeds, vertical, horizontal (in line with spindle and transverse (at right angles to spindle), are all reversible, and are operated or stopped altogether by the handle shown in the cut near the cup-board board. This reversing device, which is common to engine lathes, does away with the crossing of belts and saves time. The 4-step cone on the spindle belts to the lower cone, the shaft of which runs in a hollow stud and drives, by means of the reversing device referred to above, a shaft running through the base of the column. Bevel gears connect this shaft with the vertical shaft, and the latter by bevel gears with the horizontal shaft in the knee, which communicates in turn with the several screws for the various feeds in the front of the knee by clutch gears. These clutch gears can be engaged or disengaged at will by the knurled knobs shown in front, giving a vertical or horizontal feed. The platen feed is operated from the upper shaft in the knee by means of a pair of mitre wheels running in a bearing which is a part of the platen slide on the knee. A vertical stud passes upward to the long screw in the platen, and is connected to it by clutch mitre wheels. The screw in the platen is splined, and can be engaged and disengaged by a clutch lever, not shown in the cut, but convenient to the operator. In addition, there is an automatic stop for the horizontal feed, useful for boring. These stops can be set at any point.

The platen is 48 in. long, 14 in. wide, and has three slots for $\frac{1}{2}$ -in. bolts on the top and on the edges two slots. The platen has a transverse feed of 32 in. and a horizontal feed of 12 in. It can be turned completely around and fed in line with the spindle. It has an automatic stop, while feeding in either direction, and is secured by four $\frac{3}{8}$ -in. bolts in the swivel base, of easy access with a wrench.

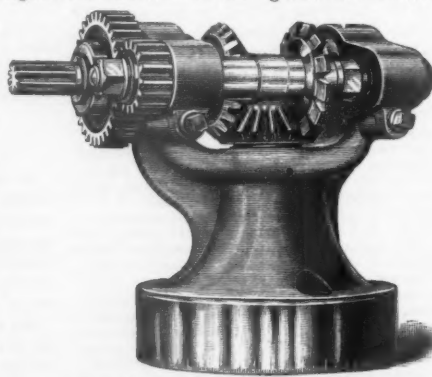
The knee is strongly designed in order to stand all strains without springing. It is gibbed, with a loose gib on the face of the column, gripped with four $\frac{3}{8}$ -in. stud bolts, and has a bearing 24 in. long and 14 in. wide. In addition, there are two slots, running the whole length of the column, for $\frac{1}{2}$ -in. bolts. The two bolts in these slots secure the knee to the ace of the column, making it absolutely rigid.

The feed gearing is protected from dirt, and all gears are steel, while the bevel gears are cut theoretically correct. The screws are also of steel and accurately cut. The dials read in decimals, or divided by 2, 4, 8, etc., enabling any measurement to be made. The principal dimensions of the machine are as follows:

Base.....	49 x 36 in.
Height of spindle from the floor.....	50 in.
Face of column.....	14 in. wide by 40 in. long.
Length of bearing of knee on face of column.....	24 in.
Top slide of knee.....	14 in. wide.
Length of platen.....	48 in.
Width of platen.....	14 in.
Length of slide-bearing for table.....	20 in.
Diameter of swivel base.....	12 $\frac{1}{2}$ in.
Vertical movement of knee.....	18 in.
Movement of slide on knee parallel with spindle.....	12 in.
Transverse movement of table.....	32 in.
Changes of speed.....	8
Changes of feed.....	4
Weight.....	6,000 lbs.

Milling Machine Attachment.

The accompanying engraving represents an attachment designed to be used with the milling machine illustrated in



Milling Machine Attachment.

Made by MESSRS. PEDRICK & AYER, Philadelphia.

another column. The makers, Messrs. Pedrick & Ayer, of Philadelphia, claim that this attachment renders their milling machine capable of doing work that can be done by no other machine. The attachment is adapted to cutting racks, spur and bevel gear, profiling or angular milling, boring or

drilling at right angles to the main spindle of the milling machine, cutting up square stock by saws, milling of slots, links of locomotives, arcs of circles, dies for sheet metal, square pieces on edge, etc., etc.

This attachment is cast hollow, and is secured to the head of the milling machine by four bolts. The base has an angular T slot and a hole to insert the bolts.

It is driven by a socket fixed in the spindle of the milling machine, which is key-seated to fit the keyed stud in the attachment. Through the medium of a pair of mitre wheels, this stud drives a spindle at right angles to the vertical attachment. This spindle is geared with a shaft in line with it, which is utilized as a cutter or saw arbor for cutting racks, sawing up stock, etc. This shaft runs in Atlas bronze bearings, and can be removed from the attachment by means of the two clamp screws in the clamp bearings.

This attachment can be used either vertically, horizontally, or at any angle around the centre, the base being graduated to register its position. Cutter arbors or boring bars can be used in either end of the main spindle. For rack cutting there is no limit as to length, while for boring or milling castings of irregular shape or troublesome to hold in other tools, it will be found very useful. In cutting large gears the cutter spindle is placed vertically and the index head at right angles to the platen. The gear blank is then fed in line with the main spindle of the milling machine. By setting the platen at an angle bevel gears may be cut. Spur gears up to six feet in diameter can be cut with this attachment in connection with the heavy milling machine, illustrated in another column.

The Fitchburg Collision.

MASSACHUSETTS COMMISSIONERS' REPORT.

The Massachusetts Board of Railroad Commissioners has made a report concerning the rear collision on the Fitchburg road at Fitchburg Nov. 30, which is substantially as follows:

Train 37, regular east-bound passenger train, left Fitchburg for Boston at 4:02 a. m. on time. The special passenger train which was in the collision was extra 37. The freight with which it collided was No. 57, and it was running under an order reading "Run to Fitchburg ahead of extra 37." The conductor of extra 37 had the following order: "57 run ahead Westminster to Fitchburg; answer red signals on 37 Fitchburg to Boston." The freight was "delayed by a switching engine 5 to 7 minutes" near the passenger station at Fitchburg and the rear brakeman went back with signals. On starting he was called in and the train proceeded to the new freight yard $1\frac{1}{4}$ miles east of the station at a speed of about 8 miles per hour. The freight arrived at Fitchburg

at 5:25 and left about 5:32. The extra passenger left Fitchburg at 5:45; the conductor of it inquired there for orders and received none, but he and the engineman were told by a car inspector that the freight had passed 10 or 15 minutes before. There is a curve in the road about 1,000 feet west of the switches at the entrance of the new freight yard; when the passenger rounded this curve the engineman saw a white lantern swung (by a man who did not belong to the freight) and applied the brakes, but the freight was only about 600 feet ahead of him, and he crashed into it with great violence, demolishing the caboose and 3 cars. One of the cars contained oil and the wreck immediately took fire; the freight cars, caboose, engine and baggage car were burned up. A drover in the caboose and the fireman of the passenger were fatally injured. The trains ran several hundred feet after the collision occurred.

The conductor and engineman of the freight train understood that, according to their orders, they had the right of way, not simply to Fitchburg station, but to the side tracks in the new yard, basing their view on the following order:

"Commencing at 6 a. m., Nov. 14, all tunnel division freight trains will run to and start from the new yard east of Fitchburg. Telegraph train orders will be given at the new yard. * * * The limits of the Fitchburg yard will extend from the River street crossing (passenger station) to the yard office at the west end of the new freight yard east of Fitchburg." [This includes in the Fitchburg yard the switches at the west end of the new yard.]

The train dispatcher, however, claimed that the freight had rights only to the passenger station, quoting rule 301, reading: "The passenger station is the point to and from which all trains are timed at Fitchburg;" and an order issued Nov. 21, taking effect the 28th, which contained the clause: "The new freight yard at Fitchburg will be known hereafter as East Fitchburg." [Nothing said about change of yard limits.]

Rule 107 reads as follows: "All trains, except regular passenger trains, must approach and pass cautiously through all yards." Rule 30 is as follows: "Any train following another train will keep a good lookout for the preceding train, and run with great caution on curves and on down grades when the position of the forward train is unknown."

The engineman of the extra passenger train claims that he had the rights of train 37. One of the rules of the road (whether in force on all divisions is not clearly shown by the Commissioners) reads as follows: "A red signal borne by a train shows that a train is following which has the same rights as the train bearing the signal, except within some of the yard limits." (See yard limit rules.) The Commissioners say that the yard limit rules do not properly cover this point, and that an extra like this has the rights of its leader in all yards or else in none of them; but they say the runner should have run cautiously because the freight was only 10 or 15 minutes ahead of him, and because he was bound, in case of doubt, to take the safe side. The Board also blames the freight conductor because he did not use extreme caution according to the general rule to always take the safe side. The conductor of the extra is held blameless. The report enlarges on the ambiguity and inconsistency of the various rules; and although the passenger engineer and freight conductor are not relieved thereby, the road is plainly censured for the looseness of the rules and is notified to revise them and advise the Commissioners within 30 days what corrections have been made. It is also recommended that fixed signals be provided for the freight yards.

Scientific Railroadings.

BY GENERAL JAMES HARRISON WILSON.

For the purposes of this article, it is sufficiently near the truth to say that the railroad mileage of the United States is about 148,000, and that the aggregate capitalization is something like \$8,500,000,000 at the present time. The number of officers and employes of all grades required to carry on the enormous business of the railroads cannot be accurately given, but may be approximately stated at 900,000 souls, and to these should be added the army employed in producing the material of railroads. I have quoted the figures above for the purpose of emphasizing the fact that the railroads represent the largest aggregation of capital and labor employed in this country, in one kind of business, with the possible exception of agriculture, and to call attention to the further fact that whatever tends to increase the profit on the capital invested, to improve the condition and service of the officers and employes, and to promote the safety of the traveling public, should receive the most careful consideration.

Hitherto capitalists and communities have been so actively engaged in creating railroads and developing the industries served by them that they have to a great extent neglected the economic questions connected with operation and maintenance. But now we have arrived at a period, when these questions are beginning to claim a large share of the study and consideration of scientific and thoughtful men, and their conclusions are being given in detail to the public by both the technical railroad journals and the secular press. The craze for building is pretty well over. Nearly all parts of the country are amply supplied with railroad facilities, and it is worthy of special notice that they have been created at a much less average cost per mile, notwithstanding "watered" stock, in regard to which so much has been said of late years, than in any other country.

If the facts could be accurately ascertained they would probably show that the amount of fictitious or "watered" stock now in existence is less than the amount of full paid stock, which has been arbitrarily wiped out by foreclosure, and I suggest as a matter of general interest, that the statistician of Poor's Manual should in the next issue give us the closest possible approximation to the truth in reference to this important question—important because the most common complaint on the part of the public is against high or "extortionate" rates, which it is averred are charged in many cases, in order to pay dividends on fictitious stock. So far as I know, or have been able to learn, this charge cannot be successfully maintained against a single railroad in the United States, for whatever may be the character of the stock in any given case in respect to "water," all the railroads of which I have any knowledge are, and have been for years, compelled to regulate their rates under competition, and when competition has failed, public sentiment has relentlessly brought the most obdurate management to terms. Public sentiment has procured the passage of the Inter-state Commerce law, by Con-

gress, and of state laws covering almost the same ground and embodying the same provisions for the government of local business—the essential principles of which are: (1), publicity, and (2), that everybody shall be treated alike under like circumstances and conditions.

This a great step forward, and, after nearly a year's experience, it is safe to say that nothing but good has come from it. Both the public and the railroads have been benefited by it, and neither has yet been harmed in the slightest degree. It cannot be claimed, however, that the Inter-state Commerce law, or any of the local laws, have been productive of their greatest good, or that that will be attained till the principle of publicity is universally applied to all contracts for transportation. It may be safely assumed that whatever has to be concealed in respect to transportation rates and contracts is wrong, and should be forbidden by the laws and severely punished upon detection. I have given the subject most careful consideration, and do not hesitate to say that if necessary to break up every sort of private contract, either directly or indirectly connected with transportation, Congress and the state legislatures should amend the laws so as to make it the duty of every railroad officer or agent entering into any contract whatever for the transportation of freight or passengers, or for controlling the same for his own line, or diverting it from any other line, in any contingency or under any condition, approximate or remote, verbal or written, expressed or implied, to make the said contract with all its conditions a matter of record accessible to the public. And every violation of this law should be made a penal offence, punishable by fine or imprisonment, or both, at the discretion of the court having jurisdiction of the case. This done, the public could safely leave the enforcement of the laws to the officers charged with that duty, and to the persons interested—at least till something further was found to be necessary.

It is asserted by some people, and believed by many more that one of the most common forms of mal-administration resorted to by railroad managers is that of falsifying the accounts, and that this is carried to such an extent that no investment in railroad securities can be safely made, and that no correct knowledge of railroad finances can be had. Stated in this way, the proposition is manifestly absurd, but I will go farther and say that I do not believe that there is any other human business which is so accurately and honestly accounted for as the railroad business of America. There have, of course, been cases of falsified accounts, but they are extremely rare, and this must necessarily be so from the very extent and complexity of the business transactions concerned. "Errors and omissions" are common, but they are generally insignificant, and even if they escape detection may properly enough be left to balance each other, or to make themselves known, in the regular course of business. Systematic falsification of accounts, owing to the almost infinite number of entries to be made and the large number of people required to make them, is not only exceedingly difficult but almost impossible to conceal or to carry on successfully. Railroad book-keeping is an exact science, which has grown *pari passu* with the railroad system, and when properly supervised, as it now is in all great companies, by auditors and controllers, responsible only to the chief executive officer and board of directors, may be safely regarded as above suspicion. A very much greater source of evil is found in the fact that the majority of the stockholders, and in many cases the officers and directors, do not read, and more frequently do not even understand the accounts which are printed for their information.

Here again publicity, which should be secured and enforced by the laws, both general and local, is the best possible protection and guaranty of accuracy. Fortunately the tendency throughout the country is to require a full sworn statement of accounts, for the public records, at fixed intervals. The practice of New York, which requires quarterly statements, is a noticeable instance of the right kind, and when it becomes universal, as it must, will leave but little to desire in respect to this important matter.

The modern world has created for itself in a little more than 50 years an entirely new system of transportation, which in the next 50 years will certainly invade and be employed in every civilized country. In its very worst and most imperfect form, it is in both economy and efficiency vastly superior to any other system of land transportation ever known, and yet precisely in respect to still greater economy and efficiency does this system now require the attention of the public and its most thoughtful men.

After an experience of nearly 20 years in building and managing railroads and studying the economic questions connected therewith, my deliberate conclusion is that the greatest need of the American railroad system at present is technical education for officers and employes of every grade, but especially for presidents, managers, traffic managers and superintendents.

There is no human calling in which so many of the arts and sciences are used as in locating, building and operating railroads. The engineering schools throughout the world are turning out annually many experts, ready and capable, from the first, or after a few years of experience, of carrying forward correctly all processes connected with the first and second stages of railroading; but it is well known that the third, that is to say, the operation of railroads, is still far from being an exact science. The business in many branches has been systematized and brought to a high state of perfection, but it is still generally under the control of men educated solely in the school of experience, and who know no higher rule than the "rule of thumb." Many of these are able and capable men, who will resent the foregoing remark, but it is safe to say that not one out of five hundred would not admit that his success would have been greater and much

more readily attained had he been prepared by proper education for his particular calling.

Notwithstanding the enormous amount of money invested in railroads, and annually paid out for their operation and maintenance, there is not a single general railroad school in the United States—not one exclusively devoted to the education of civil and mechanical engineers for railroad work, and not even the semblance of one for men who desire to prepare themselves for the administration of railroads, as auditors, superintendents, traffic managers, managers and presidents. Surely there are officers of all these grades who, like Mr. Roberts, of the Pennsylvania; Mr. Felton, of the Erie; Mr. Cassatt, who has retired at his prime to private life, and Mr. Fink, of the General Executive Committee, who have mastered and systematized the practice and principles which should guide railroad officers in the daily performance of their duties. Out of the abundance of their experience they could formulate and lay down precept after precept, which would save their own subordinates and the hundreds of ambitious young men who are pressing forward in railroad life a world of trouble if they could but find these precepts in books, or better still, taught in schools, where they could be preserved, illustrated and enlarged by a body of students and professors.

The great difficulty now is that such men as I have mentioned are too busy to teach their methods to others. Their whole time is so completely taken up in performing their own active and exacting duties, and in supervising and correlating the duties and efforts of their subordinates, that it is impossible for them to write anything but business letters and reports. Even their subordinates are in most cases left to their own devices, subject only to the dry and dogmatic rules laid down in "the book of regulations." It is within the last 20 years that the first book of this kind was compiled, and it is probable that not one in 20 railroads of the day has as yet any regulations except such as are carried in the heads of their officers or are printed on the back of their time cards for the government of trainmen.

Correct railroading is a science, or should be one. It is subdivided into many branches, each of which involves a separate trade, and could be materially improved by an intelligent effort to define and describe it, to lay down the correct principles for its practice, to show its proper place and relations to the other branches of the railroad business.

I do not here undertake to indicate what should be the organization or curriculum of the college for the education of railroad officials, nor of the technological schools for the various classes of employes, but that both are necessary seems to be a self-evident truth. Nearly every other human calling has now its college or its schools of science and technology, and is receiving great benefit therefrom, not only in the improvement of the practice of the professions and callings, but in the establishment of better relations between employer and employed, and between both and the general public.

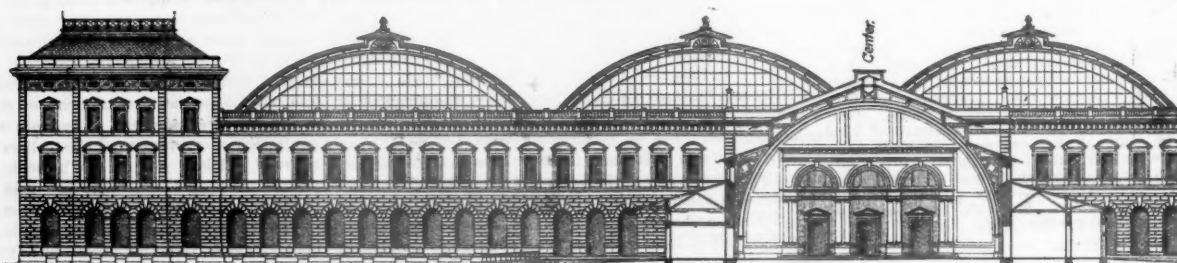
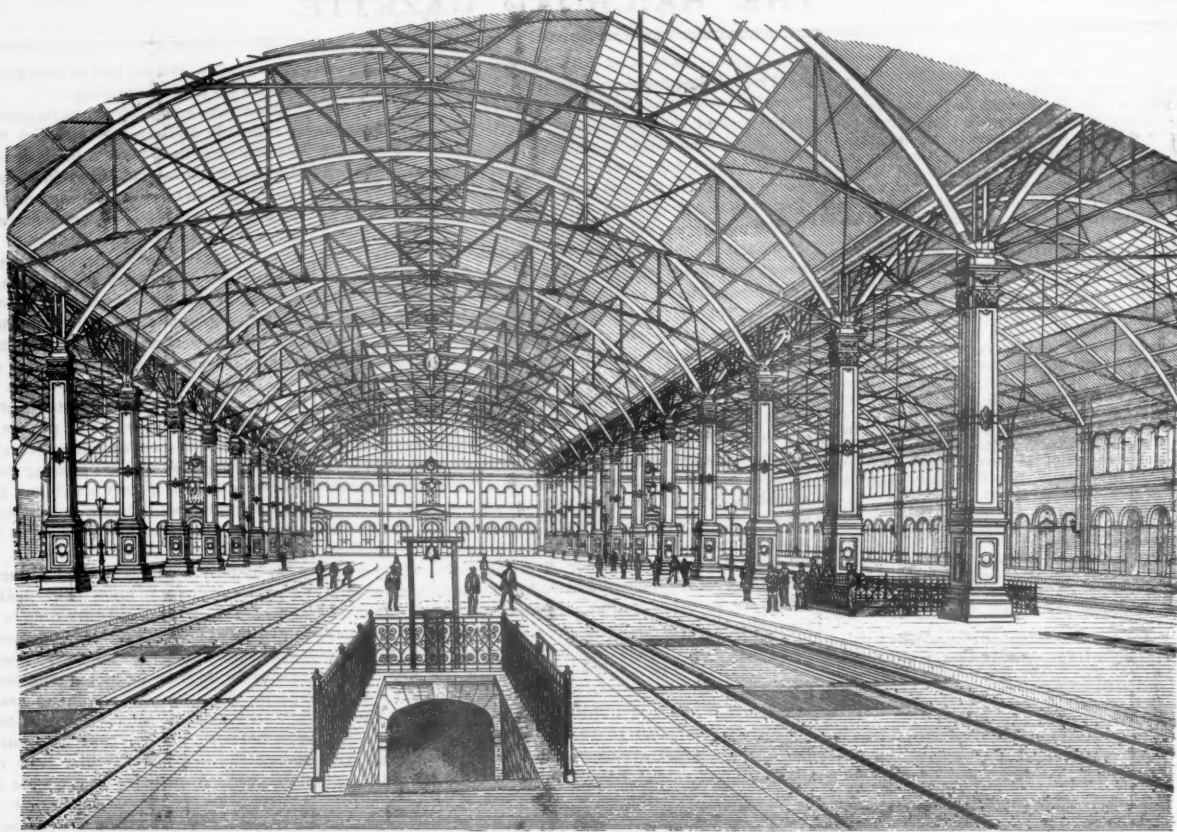
Nothing is more certain than that in metallurgy, mechanics and all the higher arts the day of main strength and awkwardness has gone by, and that "the rule of thumb" must everywhere give way to science and careful instruction. If any one doubts the sweeping truth of this statement let him send to the President of the Baltimore & Ohio Railroad Co. for a copy of the very able and exhaustive report, made to Mr. Robert Garrett, by his assistant, Dr. W. T. Barnard, on the scientific and technological schools of both Europe and America, and of their influence upon the arts and trades of the countries in which they are established.*

The same report very fully describes the efforts of the Baltimore & Ohio Company to establish a school at its Mont Clare shops, the design of which was to educate men scientifically as well as practically for all branches of the company's service, and especially for that having the care of its machinery and rolling-stock. The want of space forbids a detailed account of the company's efforts and disappointments, but I cannot forego the duty of calling attention to the fact that the first step in the organization and practical working of the school was a failure, which was in no way due to defects in its plan, but, curiously enough, to the remarkable fact that out of 500 boys and apprentices, the sons of men employed on the road, who were examined for admission to the school, not one was found to have sufficient general education to pursue with profit to himself or the company even the elementary course of scientific studies, with which it was thought essential to begin. There is nothing in the report to indicate that these boys were not up to the average in intelligence, or that they would not have made just such firemen, engine drivers and mechanics as are generally employed on the road. A trial was given to a few of the most promising of them, but not till it was opened to applicants whose parents were not in the company's service was the school filled up or such progress made as to give the slightest encouragement to the plan.

What was found to be true on the Baltimore & Ohio is doubtless true on most of the other railroads of the country; and what was true of the boys and apprentices in regard to general education, must to a greater or less degree be true of those who have risen from the same kind of boyhood and apprenticeship to be engine drivers and mechanics.

The Pennsylvania road, it is well known, has a school of theory and practice at Altoona, but so far as I can learn the young men who share its advantages are not necessarily sons of the company's own officers and employes, but are drawn from beyond the company's service and are required to possess much higher qualifications than were prescribed at first for entrance to the Mont Clare school. The graduates of Altoona are eagerly sought for, and many of them

* An abstract of this report was published in the *Railroad Gazette*, pages 263-265, for April 22, 1887.



0 20 40 60 80 100 120 140 160 180 Feet.

CENTRAL STATION, MUNICH.

now fill high places on other railroads. It has long been the practice of the Pennsylvania to choose its principal operating officers from the ranks of its civil engineers, many of whom have developed high qualities in other branches of railroading than mere construction and maintenance. Its policy has been for years to have a specially educated man at the head of every operating department. "Theory" as well as "practice" are requisite; scientific training as well as special experience are looked to in every appointment, and the result is that the road is altogether the best constructed and the best managed one in the United States, if not in the world. Its officers and employes are regarded as being at the head of their calling. A high order of discipline and *esprit de corps* exists among them, and there appears to be perfect harmony between officers and men of every grade and department.

With specially educated men at the head and in nearly every important position, and with a high degree of intelligence disseminated throughout the operating force, this company makes it the rule to give to the public the best possible service and accommodation that money can buy. Its permanent way, buildings, engines, cars and appliances of every sort are the best that can be procured. Its rates are as low as those enjoyed by the patrons of any other road, and, what is better, it never requires to be driven or coerced into treating its patrons or its employes liberally and fairly. Looked at from every point of view, it seems to be governed by men who are actuated by intelligent, educated self-interest, and therein it is a fit example for all other railroad corporations to follow.

It will not be contended for an instant that the management of the Pennsylvania Railroad is perfect, or that it cannot be improved. To the contrary much remains to be done towards increasing the education and raising the efficiency of its employes; and still more remains to be done towards convincing the country at large, and especially the stockholders and directors of railroad companies generally, that the example of the Pennsylvania is the best one to follow, and that the Baltimore & Ohio acted wisely in establishing the Mont Clare school.

Strange as it may seem, many regard any other education for railroad men than that obtained in actual service as worthless, and it cannot be denied that the common practice throughout the country is to choose presidents from successful business men, lawyers, merchants and financiers, frequently for no other reason than because they are the largest stockholders; general managers and superintendents from conductors and telegraph operators; mechanical superintendents, or master mechanics

from engine drivers and machinists; and roadmasters and engineers of permanent way from section foremen, merely because they started "with pick and shovel," and worked their way up. In many cases nothing else could be done, for the simple reason that specially educated men could not be found, but where a railroad company deliberately prefers purely "practical" men, in contradistinction to those who are "theoretical" as well, it may be safely assumed that such preference is due to gross ignorance. But when directors select for president an ex-grocer who makes it his boast that the rule of his life is "never to do to-day what he can put off till to-morrow," and a so-called general manager who was never anything more than any army engineer's clerk, and has not one ray of the information which all the intelligent men now regard as absolutely essential for a general manager, such selection must be considered as culpable in the highest degree if not absolutely criminal.

Many startling cases like the foregoing, or even worse, might be pointed out, but it is hardly necessary. Every reader of the *Railroad Gazette* can recognize the incompetents by the dozen, sailing under false colors, pretending to be railroadmen and experts when they are absolutely ignorant of every rule and principle of correct railroad management, except "the rule of thumb," and many of them even ignorant of that.

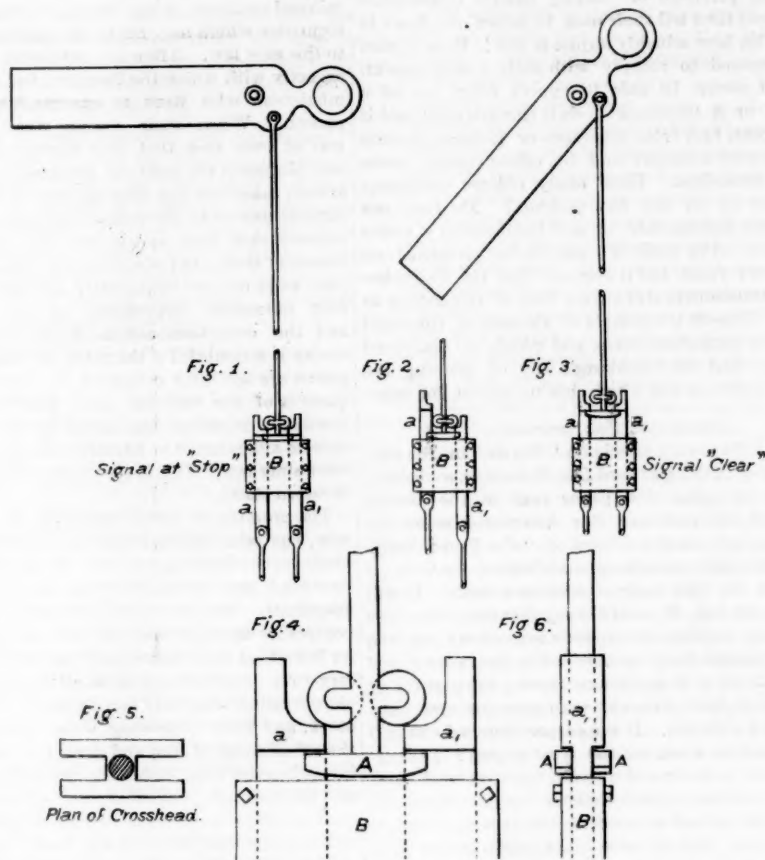
How can such men be expected to practice scientific railroading, or to throw light upon questions of railroad economics? What can they do intelligently toward promoting the most advantageous relations between railroad companies and their employes? What schemes could they lay out for the proper management of the traffic or personnel of a large railroad, or for the regulation of wages, promotion or punishments? What art or science does the average green grocer, the average lawyer, the average financier, the average merchant, or even the average conductor, telegraph operator, engine driver, or section foreman know, or what special training has any of these men had to fit him to deal with such questions as are alluded to above? Many of these men are most worthy and capable within the limits of their duties and experience, but it is no injustice to them to say that they would have been far more worthy and capable if they had had the advantage of better general instruction in youth, and the training of technological schools for their special callings after they had grown up.

We have gone through the experimental stage of railroading in the older states, and it is time we had reached the theoretical and scientific stage, as the one best calculated to

promote economy and efficiency in every department. To do this with the least effort we must begin at the head and reform downward. Stockholders must elect better directors, and pay their directors in order to secure their best service. Directors must elect better presidents—men of scientific education as well as of practical railroad experience, and such men should not be regarded as disqualified if they are, or desire to become, pecuniarily interested in the property they are to manage. In turn the presidents should select, if they can possibly find them, men of still higher scientific and technical education, and still greater practical experience for general managers and superintendents; and so on down, through all the grades, to the lowest employes.

Such railroad companies as can afford it should establish schools like those at Mont Clare and Altoona, or better if possible; and a number of the largest and richest companies—unless private individuals or some rich railroad capitalist will do it—should combine and establish a railroad college in which "theorists" alone, if theorists who are also "practical men" cannot be found, should formulate the principles of railroad construction, maintenance, accounting and management, and endeavor to teach selected men sent up from the railroads, or gathered in from other sources, the art and science of correct railroading, and the best practice in every branch of the business. In this way it cannot be doubted "the rule of thumb" will be ultimately relegated to its proper place, while those who will not follow something better will be kept in the lower grades of employment, or sent into callings where their ignorance will do less harm. Neither can it be doubted that in this way all grades of railroad officials will be gradually improved; the operatives will be elevated; their relations to the companies established upon a better and more satisfactory basis; the service systematized and perfected; accidents decreased; safety promoted; economies carefully studied and carried into effect, and finally, the earnings and dividends will be *pari passu* increased and rendered more certain.

Of course almost any railroad manager of intelligence can make practical suggestions of greater or less value for the improvement of railroad construction, maintenance, accounting and operation, and for ameliorating the condition of railroad employes, but it is safe to say that the best which can possibly be done in these directions is not too good for the public, or that it will surely pay, or that it can be reached only through the systematic study and teaching of selected men, who have the education and ability, and, above all, the time to devote to such work.



JOHNSON'S SLOT FOR SEMAPHORE SIGNALS.

Munich Central Station.

Whatever difference of opinion there may exist concerning the relative merits of the systems of railroading in this country and in Europe, the fact is undisputed that as far as ornamental appearances of stations and depots on the two continents, the Europeans are far ahead. The American engineer does not care so much for beauty as for utility, and his first duty towards the owners of the road is to build the road and terminal facilities at the lowest possible cost consistent with efficiency in service, in order not to unnecessarily increase the burdens for yearly interest on capital. On the other hand, there is hardly any fair sized city in Europe that does not pride itself on one or more large and handsome stations, and in many places the station is considered one of the most notable buildings in the town.

We reproduce from the *Organ für die Fortschritte des Eisenbahnwesens* illustrations showing the appearance of the new central station in Munich. In the illustration which shows the eastern façade the entrance hall is shown in section. The train hall is covered with four arched iron roofs, supported at the ends by the north and south station walls and in the hall by three iron columns. The western end, which is the train side, is open to a height of about 24 ft., from which height to the roof it is paneled with glass. The roof is all iron. The total width of the four roofs and of the station is 460 ft. About one-third of the roof area is covered in glass for the admission of light.

The contracts for the iron for three of the halls were let in 1877 to the South German Bridge Co., and erection was begun in October, 1878, the iron work on the three halls being all in place by March, 1881. In September of the same year the contract for the iron for the fourth hall was let to the same company. In March, 1883, all the roof work was complete.

Johnson's Slot for Controlling a Semaphore Signal.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The description of the electric slot signal in your issue for Nov. 11, 1887, prompts me to send you the inclosed sketch of a very simple mechanical device for doing the same thing which was put on a few of the Boston & Albany signals two or three years ago by the Union Switch & Signal Co., and is known as "Johnson's slot." The electric slot has the advantage of being entirely independent of the distance at which it is to be used; but for signalmen located near together, I can see no reason why it should be preferred to this device unless the necessary batteries are already in use for other purposes, and can do this additional work without extra cost.

The accompanying illustration will show the operation and construction of this mechanical slot.

Fig. 1 shows the signal at "stop" and fig. 3 at "clear." Fig. 4 is an enlarged view of the cross head and sliding pieces. Fig. 5 is a plan of the cross-head, and fig. 6 is a side view of fig. 4.

The cross-head A is connected to the rod which operates the blade. It has a small amount of lateral motion between the sliding pieces α and α_1 . The iron box B serves as a guide for these sliding pieces, one of which is connected to a lever

in the tower of the man operating the signal, and the other to a lever in the tower of the man controlling the signal.

It requires the operation of both these levers to give a clear signal, but the reversal of either will set it to danger.

Pulling forward one of these levers raises the corresponding piece α , or α_1 , as shown in fig. 2. This action pushes the cross-head A to one side, as shown. If the second lever be pulled over, the sliding bar (α_1 for instance) engages with one of the wheels with which the cross-head is fitted, marked r and r_1 , and lifts the cross-head, and the signal is set clear. When either lever is reversed, the cross-head is free to move to one side far enough to allow it to slip by the projection which held it, and the counter-weight on the blade brings it to the horizontal or "danger" position.

The wheels above referred to are used only to permit the first sliding piece to pass the cross-head without undue friction.

The simplicity and thoroughly reliable character of this device commend it for use wherever the distance does not render the electric slot a necessity.

GEORGE W. BLODGETT.

Station Lighting on the Boston & Albany.

Among the papers contributed to the International Railroad Congress at Milan was one by Mr. G. W. Blodgett, Electrical Engineer of the Boston & Albany Railroad, from which the following data are taken relating to electric lighting by that company.

At East Boston the following points are lighted by electricity: First, the grain elevator, which has six lamps in a single line opposite the scales where the grain is weighed; 2d, freight-houses Nos. 6, 12 and 13 on the east; and freight-house No. 5, pier No. 1 and the entrance on the west, where ocean steamers load and discharge their merchandise or freight to the cars; 3d, a coal wharf near the elevator, where the coal from the vessels is discharged into the cars on the tracks 10 ft. below; 4th, two engine buildings, one for the elevator engine and the other for the electric light engine. There are also several lamps in the yard near the most important switches and crossings. All these lamps are Brush lamps of 2,000 nominal candle-power. In the buildings they are placed 14 ft. high, which was the greatest height which the construction of the buildings permitted. Out of doors the height is 24 ft. Although there are 48 lamps, only 36 can be operated at the same time, which is the full capacity of the dynamo. Each lamp can be extinguished by a switch when it is not needed. It is sometimes necessary to use a larger number of lights than can be operated by the dynamo. A choice is then made of those most indispensable, and the lighting is completed by gas or oil lamps furnished with reflectors.

Electric light is used only when the number of lamps needed is nearly the capacity of one dynamo; that is to say, 18. When only two or three are needed, the gas is used.

The cost of the electric apparatus at East Boston, in place, was as follows: Buildings, \$3,116.12; 60-horse power engine, in place, \$1,787.10; shafting, pulleys, etc., in place, \$364.29; belting, \$412.30; two Brush No. 7 dynamo, \$4,000; 44

lamps, with two sets of carbons, \$3,520; two regulators for the dynamo, \$250; wires, insulators, telegraph poles and cross-arms, and labor in setting up the machinery, lamps and wires, \$1,322.75; total, \$14,722.56. The boilers used for the elevator engine also supply steam for this, and the cost of boilers or boiler-house is therefore omitted from these items. The cost of operation during the year ending Sept. 30, 1886, was \$2,277.34, or \$7.28 per day, or 20 cents per lamp per day, assuming 36 are used. This includes fuel, but not cost of boilers or boiler-house. The lamps are used irregularly. When a vessel is at the wharf they are usually burned the whole night until the loading has been completed, when they are, perhaps, not used again until another vessel arrives, if it be delayed, unless the elevator is to run at night, or cars are to be unloaded. Two men are employed to run the engine and dynamo during the night and replace the carbons in the lamps during the day. They work as many hours as is necessary—sometimes 20 hours or more in the day, when the lamps burn all night, and sometimes only 4 or 5 hours. The average is about 10 hours for the whole year. When the electric lamps are not used, these men are employed in repairs, and other work for which there is not time when the lamps are used many hours.

At Boston the passenger-station, train-house and yard are lighted by 33 arc lamps and 12 incandescent lamps. There are two Brush dynamo of 16 lamps each, and as they are run at a speed of 825 in place of 750 turns per minute, 18 lamps can be used instead of 16. They are placed at a height of 12 ft., except 5, which are about 24 ft. high. Four men are employed: two renew the carbons and make repairs to the apparatus during the day. Two others work at night: one for the boilers and engine, and another who operates the dynamo and patrols the circuits to see that all lamps burn properly. The lamps have double carbons and can burn all night. They are lighted as soon as it begins to be dark in the station, and run until after the arrival or departure of the last train. The station is lighted in the morning an hour before the departure of the first train. In summer the morning lighting is not necessary.

The cost of the apparatus, not including the engine or boilers (which are in use by the repair shops), was as follows: Two Brush dynamo, \$4,000; 33 double arc lamps, \$2,640; 2 single arc lamps, \$120; 2 automatic regulators for the dynamo, \$250; wires, insulators, fixtures, etc., and work of setting up the apparatus, not including the main shafting, etc., \$1,206.47; total, \$8,216.47. The cost of operation for the year ending Sept. 30, 1886, was \$6,465.11, or \$184.72 per lamp per year, or 50.6 cents per lamp per day. The cost per lamp hour under these conditions was about 6 cents. The cost of power furnished by the motive-power department is \$2.50 per day, besides the wages of the engineer. Carbons cost about 80 cents per day; oil waste, etc., about 3 cents per day. The cost of repairs to 5 Brush machines during the 6½ years of use has not been, it is estimated, more than \$150. Neither a lamp or dynamo has yet been replaced or sent to the factory for repairs. All such have been made by the men in charge of the apparatus. These installations were the first by a railroad company in New England, if not in America, and are still the most extensive. At Worcester the passenger station is well lighted by 20 arc lamps, placed about 15 ft. high in waiting rooms, and 24 ft. in the train-house. The cost is about twice as much as formerly paid for gas (which was never satisfactory), but several times the amount of light is obtained. The cost is 70 cents per lamp per night. It costs about the same at Springfield. At Pittsfield the electric light company light the passenger station for the same price formerly paid for gas, about \$1,400 per year.

Emery Wheel's.

The increased quantity and improved quality of the work produced by modern machine shops was partly due to the skillful use of solid emery wheels. A grain of sand from the common grindstone magnified looks like a cobblestone, a fracture of which shows an obtuse angle, whereas a grain of corundum or emery would look like a rhomboid, always breaking with a square or concave fracture. No matter how much it is worn down in use it does not lose its sharpness; hence it is evident that the grindstone rubs or grinds and heats the work, while the corundum or emery wheel with its sharp angular grit cuts like a file or circular saw.

There are two general classes of emery wheels in the market. One class of wheels has the grains of emery joined and consolidated by a pitchy material, as rubber, linseed oil, shellac, etc. These must run at a high speed to burn out the cementing material by friction, loosening the worn out grains and thus revealing new cutting angles. These are non-porous wheels and are trued up with a diamond tool.

The other class consists of two kinds, one made by mixing the emery with a mineral cement and water into a paste, which will harden and bind the grains together; the other kind by mixing the emery with a mineral flux or clay, molding into shape and burning in a muffle at a high temperature. These are porous wheels in which the grains of emery are held together by matter for which they have an affinity. This class of wheels, unlike the grindstone, has sharp grains of emery bedded together among matter which, in some cases, is as hard and sharp as the emery itself. Such wheels cut very greedily, and do not need to be run at any particular speed. The dresser, made of hardened steel picks, is the proper tool for truing up this class of wheels.

The saving effected by substituting emery wheels for files and hand labor deserves more careful investigation than it has hitherto received.

*Abstract of paper read by L. Duvinage before the Polytechnic Section of the American Institute.



Published Every Friday,
At 73 Broadway, New York.

EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and in their management, particulars as to the business of railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

We called attention last week to the fact that the traffic department of the Hungarian State Railroads was managed on "business principles" in the more shortsighted sense. The report of the Belgian State Railroads for 1886 shows that the effete monarchies are not without a knowledge of the same sort of "business" in the financial department. The figures for 1886 compared with those of 1885 show:

In gross earnings a decrease of.....	\$620,000
In net earnings an increase of.....	140,000

Such things have been known on this side of the Atlantic; and the man who is at all familiar with American railroad accounts does not hesitate where to look next. It is the same old story:

In maintenance a decrease of.....	\$380,000
In construction an increase of.....	1,800,000

Who shall say that the Belgian government authorities do not know how to run a railroad in the most approved style of the art? To show how this \$1,800,000 of new construction was made up it should be added that there seems to have been an increase of five miles of line during the year, and that the equipment reported as being under construction at the close of 1885 consisted of 12 locomotives, 1 dummy and 306 cars. There are excellent things about the Belgian railroads; but their system of accounts for 1886 can hardly be regarded as one of them.

The Massachusetts Commissioners' report on the Fitchburg collision of Nov. 30, which is summarized in another column, is noteworthy as embodying a careful exhibit of the facts, even though the accident was not made conspicuous by a long death list, and as including a somewhat unusual "recommendation" to the road concerning revision of rules and providing of signals. The board virtually says, "Correct your shiftlessness and be quick about it." With the high reputation of the Massachusetts Commission this utterance ought to have the force of law. The mission of the board is to give publicity, and the value of this feature is here shown. All officers can take a lesson from this case as well as if it had been on their own road and had killed some passengers. It would be a matter for congratulation if all cases of this kind were likely to receive a similar airing.

The board holds the men to a very high standard; the engineman of the passenger and the conductor of the freight are told, in substance, that they should have unraveled the careless, insufficient and ambiguous orders that were issued, and discerned their weaknesses. The engineman of the extra, instead of finding new rules that would justify him in running fast, should have searched for the omissions and for the old rules that were carelessly left unrepealed, which impaired that apparent justification. The freight conductor, instead of standing upon his right to consider the 1½ miles as all one yard, should have discerned the carelessness in the later order announcing the new name of the freight station, and have gone to the superintendent and extorted a straighten-

ing out of things. And this, indeed, is just what roads always require of their men. Officers claim the privilege of issuing hastily constructed orders, and then tell their men to detect the flaws in them. But how selfishly unjust is this! Even if men were disposed to comply with such a requirement, it would never be safe to expect every one of a hundred or a thousand to do it successfully; and if one per cent. fail, from ignorance or laziness, there is the chance of disaster; and the officer cannot count himself blameless. How many officers encourage their men to do this flaw-picking? Do they not rather aim strenuously at self-justification if a case comes up? The Railroad Gazette has preached on this text for years, but it appears that the Massachusetts commissioners still have a duty of reiterating its truths. Rule 30 is a sample of the sort of rules still existing on numerous roads, and which are disobeyed every day; and the Fitchburg's way of defining the rights of extras is one which has no excuse for existing.

Mr. F. J. Stimson's article on "Trusts," in the current number of the *Harvard Law Review*, is, we believe with the exception of a paper read at the annual meeting of the American Bar Association some two years or so ago, on the subject of "Car Trust Certificates," the first important contribution by a legal writer on the new topic of corporate trusts. It will hardly be the last. It is safe to say that there is in store for this new creature of corporate invention a life even more unpleasant than has been led by the railroad and all other kinds of corporations during the past ten or more years in their struggle with granger and anti-monopoly legislation. If the corporation had and still has its enemies, what can the trust expect? The corporation has no body and no soul, but it at least has a legal and visible existence, which for just cause the state can put an end to as effectually as it can strangle the anarchist. But the trust is not only wanting body and soul; it has not even these last attributes of a corporation. If it is, as is charged, a new device to enable the individual or the corporation to form monopolies and corners which the law would punish in the person of the individual or the corporation, then it is certain that it will not be long before it will find itself engaged in a contest with the law. This contest will probably be a long and a costly one, but in the end it will be found that there is no wrong without a remedy.

Already the cotton-oil trust in Louisiana and the gas trust in Illinois are being called upon to show cause and explain their status. The first case is a bill in equity brought by the state of Louisiana, charging that the defendant, the Cotton Oil Trust, is not an incorporated company, but an association of individuals acting under a secret agreement; that its purpose is to secure control of all the cotton-seed, seed oil, oil cake, etc., in the state, and to that end it has secured control of certain corporations in the state, and discriminating rates for freight from many transportation companies. The State asks for a permanent injunction against the trust, restraining it from doing business, and that it be adjudged guilty of usurping the privileges of a corporation without having been duly incorporated; that it be debarred from exercising any privileges in the state, and that it be declared an illegal and fraudulent association. The defendants demurred to this bill, which was overruled, and the case now stands for hearing on its merits. The decision in this case will throw light on the purposes and the validity of these associations, and will doubtless have no small influence as a precedent upon the decision of future cases against the trusts of other states.

THE YEAR 1887.

The year 1887 opened with good promise of prosperity. The crops of 1886 had been but moderate, and prices of agricultural products were low, but in general business was active. Manufacturers were busy, and there was a feeling of confidence which encouraged investment and stimulated enterprise. In 1886, 9,000 miles of railroad had been built, as against 8,100 in 1885, and it was apparent that much more would be built in 1887. Securities had already been placed to produce the money for much of this projected construction, as well as for extraordinary outlay in rolling-stock and improvement of permanent way. Those conditions alone assured activity and living prices in many great industries.

Nevertheless, the Inter-state Commerce act hung over the land as an element of disturbance, the force or extent of which no one could foresee. For the first six months of the year, there was much anxiety as to its effect, and it had been the pretext for a bear raid in December of 1886. But it is

hard to detect even in the transactions of the first quarter of 1887 any check to activity, any decrease in railroad earnings, or any decline in prices of railroad securities which may fairly be said to have been due to the new law. After the act went into effect the sagacity with which the President had chosen the commissioners who were to execute it soon became apparent. When their names were announced it was at once seen that they were all men of weight, not placemen nor political pensioners, and their first action, taken the day after the law went into effect, gave assurance to the railroad companies and to the country that they appreciated the tremendous interests at stake, and would move with due care. As time went on, one ruling after another confirmed the first favorable impression of the conservatism and the conscientiousness of the Commission, and to-day it is doubtful if the plans of the railroad companies are seriously restricted by fear of the consequences of the national law. There is more apprehension of injurious legislation by the states than of unwise amendment or harmful interpretation of the inter-state law. This is especially true of some of the Western states.

The promise of great extension of lines, old and new, has been fulfilled, and it is probable that the phenomenal building of 1882, when 11,599 miles of new road was constructed, has been equaled if not surpassed. But the great expenditures of the old companies in equipment and betterments have been of an industrial importance only second to the new construction. It has been apparent all through the year that the operating lines were largely increasing their rolling stock, and were improving their permanent way, by the substitution of iron and stone for wood in bridges, laying heavier rails, ballasting, putting in interlocking and block signals, and otherwise bettering their physical condition to an usual extent. As the reports come in it appears that this work has been largely done out of earnings. Moreover, securities had been placed before the greatest stringency came in the market. There is every probability, therefore, that when the financial results of the year are summed up it will be found that floating debts have been reduced, and that fixed capital charges per mile on the old roads have not increased proportionally with their earning power.

The result of the great expenditure in construction, betterments and equipment has been activity in furnaces, bridge works, rolling mills and locomotive and car shops; but notwithstanding the unusual production of rolling stock the roads have been inconvenienced for months, and still are hampered by lack of cars to move the traffic offered. Their earnings, large as they are, would have been larger had the equipment been sufficient, or so designed and managed as to be kept more constantly in motion. The reform now begun in car service will make the present stock more efficient, but the assurance remains that the car shops have another busy year ahead. It is the general judgment that new construction will fall off next year, and some of the great contractors are looking about for other fields; but it does not necessarily follow that the demand for equipment should materially slacken for months to come. Certainly the new road is not yet adequately equipped, and with continued prosperity it is nearly as certain that the older roads will continue their demand for locomotives and cars. The diminished activity in construction is, however, felt already in the rail mills. The year began with rails at \$36@37. The price quickly rose to \$39@40, but after May it began to fall off, and latterly has fluctuated between \$31.50 and \$33 per ton. Assuming that 12,000 miles of new road have been built, requiring 100 tons of rails per mile, this item alone, regardless of sidings, and of renewals on old lines, has absorbed 1,200,000 tons of rails, at a probable expenditure of \$42,000,000. Mr. Poor has estimated the cost of the new road, not including equipment, at 240 million dollars for the year. When we consider the vast sums thus withdrawn from the speculative and investment market, and then consider the further absorption of money by the establishment in the West and South of some 900 new national banks, and in other fields of productive investment, it is not necessary to look further to account for the stringency in the Eastern money market.

The year has been generally a prosperous one for the railroads. For 11 months the gross earnings of over 100 roads increased some 12 per cent., and the mileage less than 8 per cent. over 1886. The increase of 1887, in percentages of earnings and mileage, for three years was,

Compared with	1886.	1885.	1884.
Earnings.....	12.0	20.0	17.5
Mileage.....	8.1	14.2	18.9

The net earnings cannot yet be so accurately compared, but at the end of October the net earnings of 65 roads for 10 months were over 15 per cent. greater than for the first 10 months of 1886. The final results for the year will be slightly affected by the reduction of rates on the roads west and southwest of Chicago, which went into effect Dec. 20.

Rates have been generally well maintained. Open cuts have been limited in territory and in duration, and rebates or secret cuts in rates have been but little heard of. It remains to be proved, however, that the Inter-state law can take the place of pools in maintaining rates and insuring their equality. Business has been so good this year that the temptation to secure traffic by special rates has been small. The test of the law in that respect is yet to come.

The year has been one of sensible progress technically, also. The application of the air brake to freight trains has advanced. The Burlington trials proved that a train of fifty cars could not be stopped by the air-brake in its existing form without injurious shocks, but that it could be handled satisfactorily with an air-brake applied and released by electricity. So much Mr. Carpenter proved, and stimulated by the lessons, Mr. Westinghouse quickly brought out the modified form of brake apparatus with which he has demonstrated over and over again that a train of fifty cars, going 40 miles an hour, can be stopped in 580 ft., with no objectionable shock, and that at 20 miles it can be stopped in 166 ft. With the same apparatus and a train of 20 cars at 20 miles an hour, the average of a large number of stops was 99 ft. The results of these demonstrations already appear in increasing orders for continuous brakes for freight cars, and in the spread among railroad officers of the opinion that the use of such a brake is now practicable and more than ever desirable.

The question of an automatic coupler for freight cars is apparently not so near solution as that of the continuous brake, or so near as has been hoped. The Master Car-Builders have officially adopted a type, but the lines of the coupling faces for that type have still to be determined. It yet remains to fix those lines, to settle some threatening questions of patents, and to prove whether the vertical hook will be efficient and durable as a coupler and a buffer, or will need to be supplemented with an auxiliary buffer. The questions of lines and patents are probably in a way to be settled speedily. That of buffing may require further tests in practice before it will be satisfactorily decided.

The subject of heating has had much attention during the year. Many devices have been brought forward and experimented with, and it has been shown that continuous heating by steam from the locomotive is practicable and economical. The questions now are those of detail. It is likely that this coming winter will eliminate some of the couplers and some systems of distribution, and show the defects and merits of those which remain, and another year will doubtless see this method of heating in wide use.

The increased use of iron bridges has already been mentioned. The year has been remarkable for the number of short spans replaced by plate girders or iron trusses. This is one of the most important changes in practice. The long span bridges are reasonably sure to be built with some approach to the best usage, but it is the little ones that are most pernicious. A further notable advance in this direction is that of the Pennsylvania in the use of stone arches for short spans.

Aside from the marked progress in brakes, couplers and heating, the operating departments have made no great advance. Interlocking switches and signals have been introduced more rapidly than ever before, but this action is simply forced upon the older roads by the pressure of increased business. Over one hundred miles of road have been equipped with block signals, which is a marked advance, the use of the system in this country having hitherto been confined almost wholly to the Pennsylvania road and one other.

A change in the methods of borrowing and lending freight cars has been begun which promises to reform the existing anomalous state of things, wherein a large percentage of the enormous investment in rolling stock is wholly unproductive. The arduous labors of the eminent officers who produced the uniform code of train rules have been finished, and all who appreciate the value of their work are now enjoying the benefit of it.

On the whole the year has been one of great material prosperity. Indeed it seems not too much to say that it will be found to have been the most solidly prosperous year of our history. To this condition the railroads have contributed much and in the results they have shared.

Reduction of Rates in Illinois and Iowa.

The reduction in freight rates which went into effect in Illinois and Iowa on Dec. 20 is to a great extent a result of the Inter-state Commerce law. When that law commenced its operations it necessitated re-arranging many rates in the West. The Eastern trunk lines and their Chicago connections established a mileage scale of rates on west-bound business, making substantially the same rate per mile to all points. The adoption of this scale by roads west of Chicago would amount to putting themselves on a par with the trunk lines, and doing business upon the same rates as the latter. Some of the roads considered that this could be done, and commenced pro-rating to Mississippi River and in some cases to Missouri River points on the same mileage rate that existed east of Chicago, the Wabash being among the number. Other lines claimed that the relatively lighter traffic west of Chicago could not stand the rates that the Eastern lines could do business for and yet live, and protested against this action by the others. If the rates could not be raised on through business to be nearer the local rate, the roads advocating the higher rates claimed that they would be obliged to cut down their local rates on a large number of articles to figures nearer the new through rates, in order to keep within the letter of the Inter-state law.

In September, the Illinois roads were called before the Illinois Railroad Commissioners to answer complaints made from Peoria, Rock Island, Decatur and other cities, to the effect that Illinois roads were discriminating against Illinois industries and interests; and at that hearing it was shown that rates from points outside the state were less than from state points much nearer, the rate from Indianapolis to Quincy, for instance, being less than from Rock Island, and those from Chicago to Quincy by the Wabash more than from Toledo to Quincy. This condition of affairs undoubtedly worked an injustice to some of the points in question. It was not specially urged at the hearing that the Illinois rates were of themselves too high, but that they were too high by comparison; the Inter-state rates were too low.

Before making reductions an attempt was made to induce the competing roads to at least partially raise their Inter-state rates, but without success, the Wabash being the main stumbling block, though the inequalities complained of were not established by that road alone. The negotiations failing, there seemed no alternative but to reduce many local rates, especially on west-bound traffic, to meet the inequalities of the Inter-state traffic. This reduction is mainly in the various merchandise classes, first class being reduced from 50 to 40 cents, Chicago to the Mississippi River, rates on other classes and to other points being reduced in proportion. These rates also affect Iowa by comparison. The through rate from Chicago to the Missouri River being reduced from 90 cents to 75 on first class, the sum of the Illinois and Iowa locals would exceed the through rate, and by agreement between the Iowa Commissioners and the Iowa roads a new tariff was established equalizing matters in Iowa as well as in Illinois. The new rates do not include grain, live stock, lumber or coal. The reduction on the articles covered will range from 15 to 25 per cent. of the former rates, and the total reduction in revenue to the Illinois roads will probably amount to 10 per cent. on the freight traffic. This tariff, though nominally inaugurated by the leading roads from Chicago west, will doubtless be followed by all lines in the state; and, in fact, a new schedule is being arranged by the Illinois Commission, which will probably call for reductions nearly, if not quite, equal to that made by the roads in question.

The roads inaugurating this reduction have fully counted the cost, mindful of the fact that Illinois and Iowa have their full quota already of roads finding it difficult to make both ends meet, and that this action would not be likely to lessen their number; but the reduction had to be made in justice to patrons along their own lines. The gravity of this action is heightened by the fact that gross earnings and tonnage in Illinois and Iowa have not materially increased so as to allow room for any lower rates, and in fact the traffic outlook is doubtful in comparison with last year on account of partial crop failures, and the fact that, by the building of new roads, competition is steadily increasing. Neither does the local business done in the states in question increase in proportion to the growth of the country and the additions to railroad mileage. While the local towns are increasing in size and importance they afford local markets for much produce which would otherwise go to the great trade centres, and the traffic which they offer is mainly manufactures and condensed products which, though rated in higher classes

than farm products, do not afford revenue enough to make up for the reduction in tonnage on crude articles. While this process has, perhaps, not reached as high a point in Iowa as in Illinois, the tendency is certainly that way, and the roads are obliged to reach out more and more after traffic which, by its bulk and length of haul, will make up for the low through rates and also balance the loss of gross revenue on local business. That this is being done is shown by the rapidly increasing proportion of inter-state to local business, the former amounting on some western lines to nearly ninety per cent. of the total freight traffic handled.

TRACTIVE POWER AND TRAIN RESISTANCE.

The conditions which govern the haulage power of locomotives are even at this late date occasionally misunderstood, as is evident from the letter of D. C. S., which will be found in another column. Our correspondent falls into the old fallacy of estimating the tractive power of a locomotive solely with reference to the adhesion weight, and neglects altogether the average pressure of steam in the cylinders, which is one of the three essential facts which must be known before the gross weight of train which an engine will haul up a given incline can be calculated. The resistance of the train due to journal and flange friction on curves enables an estimate to be made of the work the engine has to perform. The requisite average pressure in the cylinder can then be calculated, and if not above 85 per cent. of the boiler pressure, while the gross tractive power thus obtained is about one quarter of the weight on the driving wheels, it is tolerably certain that under favorable circumstances the load can be hauled.

D. C. S. considers that our estimate of the maximum train that can be hauled by the ten-wheeled passenger locomotives of the Colorado Midland is too sanguine,* and that the tractive power on the slippery inclines of that road should not exceed $\frac{1}{4.25}$ of the weight on the driving wheels.

The latter statement may be true as regards the mountain inclines on the Colorado Midland, but as our estimate of the maximum tractive force of the engine is only $\frac{1}{4.4}$ of the weight on the drivers or within the limit assigned by D. C. S., it is evident that he has nothing to complain of on that score.

D. C. S. also has no fault to find with the assumption that the maximum average pressure per square inch on the piston is about equal to 85 per cent. of the boiler pressure. This figure was arrived at after a careful examination of the records of many tests, and was first published in these pages, and has been generally accepted.

D. C. S. differs from most authorities in assuming that the resistance of passenger cars in good order on sharp curves is as high as 1 lb. per degree of curvature in addition to a journal friction of 10 lbs. per ton. An example will illustrate this point. In some careful trials made in Brazil, on the Paulista Railroad, an engine, having 88,700 lbs. on the drivers, hauls regularly a freight train weighing 1,160,320 lbs. (including engine and tender) up a long grade of 88 ft. per mile, with 6 degree curves.†

According to D. C. S. the total resistance, including gravity, would be 49.3 lbs. per ton, or 28,514 lbs.

But this figure is $\frac{1}{3.11}$ of the weight on the drivers, and moreover the engine would have to maintain an average pressure in the cylinders of 142.5 lbs. per square inch, which is rather suspiciously high. It is evident that the resistance was considerably less than is obtained by reckoning on the lines laid down by D. C. S. Taking the journal friction at 6 lbs. per ton, and the curve friction at $\frac{1}{2}$ lb. per degree, the total friction, including gravity, would be 41.3 lbs. per ton, and the gross resistance would be 23,954 lbs. This figure is $\frac{1}{3.7}$ of the adhesion weight, and the average pressure required on the piston would be nearly 120 lbs. per square inch. As both figures are unusually high, it is probable that the train resistance due to all causes except gravity was less than 8 lbs. per ton. As these results were obtained in regular work with freight trains, it is tolerably evident that our correspondent's assumption as to passenger train resistance is far too high.

The locomotive and rolling stock on the Paulista being of English design and construction, it may be interesting to analyze the figures as to the performance of an engine and cars of American build. The Mastodon class on the Central Pacific have hauled 20 loaded freight cars up long inclines of 116 ft. to the mile, with frequent 10-degree

* See page 761, Railroad Gazette, Nov. 25, 1887.
† Recent Locomotives, enlarged edition, page 89.

curves.* The weight of the cars and lading was about 844,000 lbs., and the weight of the entire train, including engine, tender and caboose, was about 1,050,000 lbs. According to D. C. S., the journal friction should be 10 lbs. and the curve friction also 10 lbs. per ton, making the total train resistance, including gravity, 61.3 lbs. per ton. The gross resistance for the whole train would therefore be 32,183 lbs. This figure is, however, manifestly too high, as it is $\frac{1}{3.19}$ of the weight on the drivers, and in order to exert this tractive force the engine would have to maintain an average pressure of over 142 lbs. per square inch in the cylinders. As indicator diagrams showed that the maximum average pressure ever obtained was only 124 lbs. per square inch, it is evident that the tractive force did not exceed 27,000 lbs., which is about $\frac{1}{3.8}$ of the weight on the drivers. Assuming, however, that this high result was reached, the total resistance of the train was only 51.4 lbs. per ton. As the effect of gravity is equal to 41.3 lbs. per ton, the combined axle and curve resistance could not have exceeded 10.1 lbs. per ton, or about half the amount calculated on the basis given by D. C. S.

These figures can be confirmed by generally trustworthy examples from actual practice. Cases have occurred where trains have stalled, though the tractive force apparently required was less than one-fifth of the weight on the drivers, but such cases can nearly always be traced to a deficient supply of sharp, dry sand. The resistance of trains is also a factor which varies enormously, and in some careful experiments made many years ago with individual cars, the friction on a straight level piece of track in ordinary weather at a slow speed was found to vary from 3 to 56 lbs. per ton in different cars. Doubtless the journals and brasses in one case were exceptionally smooth and well-fitted, and properly lubricated, and in the other case the journal was probably badly cut by previous heating and would serve better as a nutmeg grater than as a car journal.

Assuming cars in good condition and all the circumstances favorable, it appears that experience shows that an allowance of 10 pounds per ton for friction is enough for even curves as sharp as those on the Colorado Midland. It would not be advisable to reckon on such a low figure for everyday working, but in speaking of the maximum train that can be hauled, it is clearly understood that it is neither possible or expedient to work any locomotive to its maximum power continually. Some allowance must be made for weather and cars in bad order, causing increased resistance, while poor coal or leaky tubes, or a weak safety valve spring will render it impossible to always maintain steam at the blowing-off point. It is, however, customary to assume that an engine can as a maximum effort maintain an average pressure in the cylinders equal to 85 per cent. of the boiler pressure. When, however, a long grade has to be surmounted, it will be found in daily practice that a pressure of not more than 65 per cent. of the boiler pressure can be safely reckoned on. If the engine has constantly to haul a train so heavy that the average pressure on the piston must for long distances equal 80 per cent. of the boiler pressure either one of two things will occur. The engine will occasionally lose time or possibly be stalled, or the engineer will fix the safety valves so that they do not pop quite as soon as the designer intended. The train load given for the Colorado Midland engine may be fairly assumed to be the maximum which she is capable of hauling, and results obtained elsewhere show that our figure is probably fairly correct. It, however, by no means follows that this maximum load can be hauled every day, in fair weather and foul, and in order to insure regularity of working and provide some margin against accidental delays at stations and crossing points, it would be prudent to run the engine regularly with a considerably smaller load, though the full train of six cars could be hauled on an emergency, provided the conditions were favorable.

Stock Watering and Some of its Results.

In a communication which is printed on another page, General James H. Wilson speaks of "watered" stock in its relation to alleged consequent increased charge for transportation, and he argues that competition and public opinion will sufficiently protect the community. So far he is right, but there are still other considerations which forbid making rates according to capitalization. We shall have more to say on this subject in another issue, as well as concerning

directors and accounts. The worst evils of stock watering are probably those seen in the results upon the operating force and physical condition of a railroad. In most cases where large issues of railroad stock have been made representing only profits of construction, or "water," the shares have necessarily become a football in the market, selling at low prices, without hope of dividend, and proprietorship has constantly changed hands according to the pulsations of speculation. With an unstable body of shareholders the tenure of office in the management and administration is unstable, the best talent cannot be secured, and there is no *esprit de corps* among officers and employees. The conditions of service become too much like those in a government bureau, subject to change of political party. The influence of a stable and divided proprietary upon the operation and conditions of a railroad, are well illustrated by the history of the New England corporations, whose shares in almost all cases represent full moneyed payment, and a corresponding creation of values, which have commended the shares as an investment to a scattered proprietary, dwelling, oftentimes, along the lines. The communities are in this way made participants in the successful operation of the roads, and interested critics of any dereliction in their management. In contrast with this condition will be found the ownership of many other railroads, where the communities having no moneyed interest, or even knowledge of or sympathy with the proprietors, are arrayed in constant hostility to the corporation, seeking only to enforce every possible exaction through courts and legislatures.

It is probably true that a large portion of the mileage now existing in the United States would not have been so speedily created had it not been for the system of over-capitalization which has made it profitable for capitalists and promoters to float new schemes of railroad construction. The individual losses which have followed have probably been more than compensated for by the national growth promoted by the extensive railroad construction. But if such unwholesome stimulation was ever of permanent good to the country at large, we may safely assume that the time for it is past. Building railroads, as well as operating them, should henceforth be, and doubtless will be, more of a logically ordered business and less of a speculation than it has been in the past. We have now a body of data accumulated which enables investors to calculate with some accuracy the cost and the consequences, both immediate and remote, of any projected line; and they should, and doubtless more often do, insist that schemes of capitalization shall be adjusted to the basis of real expenditure. Fictitious capitalization has been the basis of innumerable schemes which have swamped important properties in the past, and have made them mere counters on the stock exchanges and the prey of moneyed combinations who have purchased control for a brief period for the sake of carrying out plans of individual profit, directly detrimental to the public and to the creditors and proprietors of the corporation. One has only to read the past history of enterprises like the Erie, the Ontario, New York & New England, East Tennessee, Texas Pacific and many other corporations to appreciate the evils which have followed from the easy transfer of control through the temporary acquisition of discredited shares. In the case where watered capital has been issued in the shape of bonds, more pernicious consequences have been entailed from the struggle of managers to maintain payment of their fixed charges as long as possible, even at the cost of allowing the physical condition of their roads to deteriorate. Finally this deterioration reaches a danger point when further starving of the property becomes impossible, when follow receivership and reconstruction with their train of loss, confiscation and demoralization. The cure must come from the prevention of the issue of railroad capital except for *bona fide* cash payment; but the wisdom or practicability of legislation to this end is questionable. A fool and his money cannot be kept together even by law. It is suggested that provision could be made by which all plans for the issue of new securities, whether bonds or stock, should be laid before the Railroad Commissioners of the state, in such states as have commissioners, for their examination and approval, and this is the direction perhaps that the legal regulation will take.

Guard Rails for Bridges.

On another page will be found a circular lately issued by the Board of Railroad Commissioners of Massachusetts to the railroads of that state. The Board specifically recommends a certain form of bridge guard, to consist of outside guard timbers and inside rails. It will be remembered that in 1881 the Board presented to the roads for consideration eight forms

of track structure designed to increase the safety of trains and bridges in cases of derailment. That circular and the drawings which were sent out with it were published in the *Railroad Gazette*, Jan. 30, 1883. At that time the Board did not recommend any special one of the forms presented, but stated the essentials of a safe and efficient form of bridge track construction to be "strong and closely laid ties of sufficient length; guard-rails, or guard-timbers lined with angle-iron; these timbers outside of the track and notched or bolted down, or else separate outside stringers, notched and bolted down to the ties." It will be seen that in its earlier circular the Board makes the outside guard essential, while the inside guard is only permissible, or perhaps desirable. In the form now recommended both are made essential. The special functions of each are recognized. The outside guard is to keep the ties in place, and otherwise help to keep the floor intact, while the duty of the inside rail is to keep the wheels in line. While the Commissioners expressly recommend rails inside, presumably they would accept as equivalent, timbers faced with angle-iron. The position taken by the Board in favor of inside guard rails seems very judicious, but on this question good authorities still differ. As a part of the floor system the guard timber is more efficient when placed outside, near the ends of the ties; while, as a guide to derailed wheels the greater efficiency of the inside guard seems equally certain, and the highest efficiency cannot be got by putting the two distinct duties upon one member. The fundamental, and the strongest, argument of the Commissioners for the inside guard is that by the use of it the wheels of a derailed axle are directed toward the centre line of the bridge and not toward the truss. The wheel to strike the guard and be retarded by it is that inside the rails, and the natural result must be to swing the axle toward the track. With an outside guard the action is directly reversed, and with a guard of timber only, this unfavorable action is helped along by the wheel cutting into the wood. The Commissioners consider the objection sometimes made to the inside guard, that it cannot bring back to line a truck which is half the gauge or more away from the rail, and suggest that when this condition has arrived neither outside nor inside guards would be likely to be of much use. They do not suggest, however, what seems good doctrine, that in such a case it would be best to ditch a car before it gets to the bridge. To this end it would be desirable to extend the inside guard a considerable distance beyond the bridge and to carry the outside guard timbers only to bunter posts near the ends of the trusses. The Commissioners recommend 30 ft. as the minimum distance beyond the bridge at which the point of the inside guard should be placed.

There are other points in which the inside guard is superior to the outside. With the same height the wheel will not mount it so readily, for the inside guard is struck by the flange of the wheel, where the circumference is larger, and the line of contact not so sharp. The rounded edge of the flange is less likely to bite into the guard than the sharp edge of the tread. With equivalent heights the inside guard can be placed nearer the rail than the outside guard. The objection to the inside guard rail that it offers greater chances for malicious derailment, is unquestionably worth consideration, but, without calling it a fanciful objection, we still think it is far outweighed by the advantages which have been pointed out. A valuable discussion of this subject will be found in a paper presented by Mr. W. Howard White to the American Society of Civil Engineers, of which an abstract was published in the *Railroad Gazette*, June 6, 1884.

The Board speaks guardedly of rerailing devices. In this we think it might have gone further, and instead of saying that it "does not desire to be understood as withholding its approval" it would have spoken for economy and humanity had it distinctly approved of them.

Perhaps the Board feels the importance of making haste slowly, and therefore refrained from making, in this circular, any reference to hand rails or other provision for the safety of those walking on bridges. To be sure a man who trespasses on a railroad bridge should be punished, but if he is knocked off by a locomotive it cannot be held that the punishment fits the crime, and there are certain classes of railroad employees who must cross such structures. For them some refuge or protection should be provided, at least on long deck bridges or trestles. There are obvious objections to making such places any more attractive to tramps or other pedestrians than they now are, and for that reason, as well as for the sake of economy, it would be well to recommend nothing more than one substantial running rope, or light rail of gas pipe.

* Recent Locomotives, enlarged edition, page 65.

Forgotten Train Orders.

It is stated that a recent collision on the Pittsburgh division of the Baltimore & Ohio resulted from the failure of an operator to deliver an order. The reason for this is not given. An occurrence of this kind would seem to be impossible if the dispatcher were to assure himself, in every case, of the delivery to the train having right of track, before allowing an inferior train to use a corresponding order against it. This should be insisted on whenever practicable, but, unfortunately, with a mixed traffic and inability to supply the requisite number of telegraph stations, this is in many cases deemed out of the question. The importance of this is recognized in the uniform code adopted by the General Time Convention, in which it is provided that it shall be done "whenever practicable" (Rule 510).

Much of the danger of orders not being delivered which formerly existed is now obviated by the use of fixed signals and specific rules for their use. The uniform code proposes two methods, each having its advocates and its merits.

Rule 522—A is upon the principle that the normal position of the signal shall be "danger," and it is usually understood that it goes to danger automatically. The signal is moved to safety to permit a train to pass for which no orders are in hand, and usually is so held by the operator until the train has passed.

Rule 522 B reverses this arrangement. The normal position is "safety." "Danger" is shown when an order is sent, and must remain until all orders are delivered. No train may pass a signal showing "danger," without getting an order or clearance card. Whether it is understood that the signal moves automatically to safety does not appear from any of the published discussions, but probably not, as in that case it would have to be held at "danger," or fastened by fixtures which might fail to hold.

The "normal at danger" method is held by many experienced officers to be correct in theory and to be more generally applicable than the other. It admits of allowing trains not concerned with the orders in hand to pass without stopping. This in many cases is of vital importance. A road having a heavy freight traffic requiring the issue of large numbers of orders cannot well afford to stop its express trains, nor indeed other freight trains, at every point where an order may be placed for a freight train, as is necessary under the other plan. The risk in this plan, however, is that an operator, who has frequently to move his signal to "safety" for trains to pass, may carelessly or mechanically do this for a train for which he has orders. This has actually occurred, and sometimes with operators who were asleep and were not aware on waking that a train had passed. In one instance within our knowledge the recognition of this risk has led to the adoption of a device to guard against it. The short lever by which the signal is moved stands upright against the wall, above the operator's table and at his left hand. A box, say two feet high and eight inches wide, inclosing the lever, projects three or four inches from the wall. The front is a door with hinge next the operator. It closes with a spring and a catch. Before operating the lever, the catch must be drawn and some force exerted to open the door. This requires attention and some effort. On the door is a rack in which orders on hand are placed, thus meeting the eye and hand in any attempt to open the door. This would seem to go far toward preventing a careless or unconscious movement of the signal. A further improvement would be a catch which could only be operated by a key which would be discharged from the keyhole on the closing of the door. The comparative infrequency of the occurrence here guarded against, in the experience of any one road, probably accounts for the absence of appliances intended to prevent it.

The risk of "automatic" movement by the operator is supposed to be obviated in the "normal at safety" plan; whether entirely so may be doubted. The signal is required to be placed at "danger" when trains are to be stopped for orders, and not changed to "safety" until the object is accomplished. The habit of frequent changes for trains to pass is not so likely to be formed under this system; but it is still not entirely absent, and a person engaged in other duties, or partly or wholly asleep, may unconsciously change the position of the signal when orders are in hand. The danger is at least sufficient to warrant precautions against it.

The insuperable objection to the latter method, in many cases, is that it involves the stopping of express trains at points where they should not stop, and much loss of time to freight trains, which have to be stopped where there are orders in which they are not con-

cerned. It may be said that loss of time should not weigh as against safety, but it cannot be doubted that the interests involved in the rapid movement of passengers and freight would speedily rebel against the adoption of methods which, while theoretically providing absolute protection against risks which are practically guarded against by means consistent with the requirements of traffic, are really not absolute in their protection, and would involve delay in movement which must prove annoying and expensive.

The whole system of train orders as now elaborated is the outgrowth of the exigencies of heavy traffic, the multiplied risks of which require increased complication in methods of movement. Very much has been done in simplifying the methods and in reducing them to a compact and consistent system, and in the point under consideration the Convention has presented two methods, each involving important principles, and each adapted to circumstances to which the other might not apply. This action is undoubtedly wise.

Whether either plan will ever give way generally to the other is still a question. An intelligible consensus of opinion has been hard to get, in fact unattainable, and many valuable points illustrating the bearings of the various principles have doubtless been buried in oblivion, because no means of publishing or gathering them has been at hand. But in the Time Convention, actuated by its present spirit, there is a ready channel for the collection of facts of experience which may lead to clearer conclusions than have hitherto been possible. Doubtless the members of the committee had decided views, and the fact that the committee was so evenly balanced as to withhold approval of one or the other system may have been accidental.

Those who have carefully studied this and kindred problems most recognize the importance of considering every circumstance minutely. It is desirable not only to settle in one's own mind how many mistakes or lapses have occurred or will occur under a given system, but the immediate and remote causes as well, where discoverable. When a collision occurs an officer instinctively theorizes as to the mental processes of the delinquent person or persons. This is well; why not jot down these speculations and compare notes? It is not unlikely that an operator, conductor or engineman who forgets an order might, by fully explaining his error to the best of his ability, sensibly aid his brethren to avoid being wrecked on the same rock.

There can be little doubt that many operators are too young and that some are too old, and that a little inspection would disclose numbers of them whose habits of mind and sense of responsibility are loose and unsystematic. These at least will bear looking after: and where the rule requiring the consent of the ruling train to be always first obtained is laid aside or suspended simply from lack of officers, operators or dispatchers, it will be well to consider whether the lives of passengers and trainmen and the reputation of the road do not demand an increase of facilities in this direction. Whatever be the system in use it cannot be too strongly insisted that those engaged in the issue and delivery of train orders should be under constant and careful supervision. This is unfortunately too often neglected, with resulting carelessness on the part of operators and trainmen in this important branch, until attention is called to the deficiency in management by some serious calamity.

Railroads and the State Constitutions.

The United States Constitution contains, of course, no reference to railroads, nor have any of the amendments adopted since contained any reference to them in express words. The jurisdiction of the national government to regulate railroads arises under its general police powers, its express power to regulate trade and commerce between the states, and perhaps its express power to maintain post roads. It may safely be said, however, that if we were at this time adopting a new national constitution the railroad would be mentioned in it more than once. The state constitutions which have been drafted and adopted within the last quarter of a century show an increasing desire on the part of the people of this country to place their representatives out of the reach of the influence of the railroad corporation, and at the same time to give them express authority to pass special laws for the regulation of the railroads. A careful examination of the different state constitutions shows that in no less than thirteen of them the railroad is expressly mentioned. The constitution of Arkansas has more to say of the powers of railroads and the rights of the people over them than that of any other state, though close behind it come Missouri and Pennsylvania. Then follow California and Texas, Nebraska, Illinois, West Virginia and Colorado, while Louisiana, Michigan, Georgia, New Jersey, New York and Minnesota bring up the rear in the order named. In the constitutions of Connecticut, Delaware, Florida, Indiana, Iowa, Kentucky, Maine, Maryland, Massachu-

setts, Mississippi, New Hampshire, North Carolina, Ohio, Oregon, Rhode Island, Tennessee, Vermont, Virginia and Wisconsin the railroad is not mentioned.

The constitutions of Arkansas, Alabama, Colorado, Illinois, Louisiana, Missouri, Nebraska, Pennsylvania, West Virginia and Texas declare all railroads to be public highways. Those of Arkansas, Colorado, Illinois, Nebraska and West Virginia contain the further statement that railroads are free to all persons for the transportation of themselves or their property under the regulations prescribed by law. The constitutions of Alabama, Arkansas, California, Colorado, Louisiana, Missouri, Pennsylvania and Texas declare railroads to be common carriers, and that of Nebraska prohibits them from limiting their liability.

The constitutions of Alabama, Arkansas, Georgia, Illinois, Missouri, Nebraska, Texas and West Virginia provide that the Legislature shall pass laws to correct abuses and prevent unjust discrimination and extortion in the rates for freight and passenger transportation. In Illinois, Michigan, Missouri, Nebraska, Texas and West Virginia the Legislature is empowered to pass laws establishing reasonable maximum rates of fare and freight. In California this authority is given to the railroad commissioners.

It is provided by the constitutions of Arkansas, California, Missouri and Pennsylvania that no railroad shall charge for freight or passengers a greater amount for a less distance than for a greater, but excursion or commutation tickets may be issued at special rates. By the constitution of Georgia it is declared that no rebate or bonus shall be paid by a railroad directly or indirectly, nor any act be done which shall mislead the public as to the real rates charged or received for freight or passage. By the constitution of California, a railroad having once lowered its rates cannot put them up again without the consent of the railroad commissioners.

By the constitutions of Alabama, Arkansas, California and Missouri, no railroad is allowed to give free passes or tickets at a discount to members of the Legislature, or state or municipal officers, and the acceptance of such a favor forfeits the office held by the donee. The constitution of Pennsylvania prohibits free passes or favors to any persons except officers or employés of the company.

The constitutions of California and Pennsylvania provide that no discrimination in charges or facilities for transportation shall be made by any railroad or other transportation company between places and persons or in the facilities for the transportation of the same classes of freight, or passengers. The constitution of Arkansas, Colorado, Missouri and Pennsylvania prohibit discrimination in charges or facilities in transportation between transportation companies and individuals or in favor of either by abatement drawback or otherwise, and no railroad shall make any preference in furnishing cars or motive power. The constitutions of Arkansas, California and Colorado enact that no undue or unreasonable discrimination shall be made in charges or facilities for transportation of freight or passengers within the state or going to or coming from any other state. By that of Minnesota it is declared that all railroads being common carriers enjoying a right of way shall carry the productions of the country on equal terms.

The constitutions of Alabama, Arkansas, California, Colorado, Louisiana, Missouri, Pennsylvania and Texas declare that every railroad has a constitutional right to connect with or cross any other railroad. In Alabama, Arkansas, California, Missouri, Louisiana, Pennsylvania and Texas every railroad is required to receive and transport the passengers and freight or cars of any other railroad without delay or discrimination. In Illinois they must deliver grain at any elevator or warehouse which can be reached by their tracks and allow other warehouses or coal-banks to make connection with their tracks. In Michigan the Legislature is required to prohibit discrimination in contracts between railroads against other roads connecting or intersecting. In California no railroad or other common carrier shall combine or make any contract with the owners of any vessel that leaves port or makes port in the state, or with any common carrier by which contract the earnings of the one doing the carrying shall be shared by the one not doing it.

By the constitutions of Arkansas, Colorado, Illinois, Michigan, Nebraska, Missouri, Pennsylvania, Texas and West Virginia no railroad can consolidate with a parallel or competing line. By those of Arkansas, Missouri, Pennsylvania, Texas and West Virginia a railroad cannot purchase or lease a parallel or competing line; nor in Arkansas, Missouri, Pennsylvania and Texas can an officer of the one act as an officer of the other. In Texas no railroad in the state may consolidate with any road organized in another state. In Colorado, Louisiana and Missouri it may so consolidate but it will remain liable to the home jurisdiction. In Illinois, Michigan and Missouri, Louisiana and Nebraska notice of any proposed consolidation must be given to all the stockholders of both roads. In Arkansas, Missouri and Pennsylvania the question whether roads are parallel and competing lines is declared to be a question to be decided by the jury.

By the constitutions of Arkansas, Illinois, Missouri, Nebraska, Texas and West Virginia, the rolling stock and movable property of railroads are declared to be personal property, and the Legislature is prohibited from passing any law exempting them from execution.

By the constitution of Nebraska no railroad organized in another state can exercise the right of eminent domain or acquire real estate or a right of way in the state until duly incorporated therein. In West Virginia no railroad may run within half a mile of a town of three hundred inhabitants without establishing a station for it. In Texas no railroad can pass within three miles of a county seat without passing through the same and maintaining a station therein, if the

town will give right of way and land therefor, unless prevented by natural causes.

The constitution of Illinois provides that a majority of the directors of a railroad must be citizens and residents of the state. In Arkansas, California, Missouri and Pennsylvania, no president, director, officer, agent or employee of a railroad shall be interested directly or indirectly in the furnishing of material or supplies to such company or in the business of transporting freight or passengers as a common carrier over the company's line.

In Pennsylvania the constitution says that no company doing the business of a common carrier can engage in mining or manufacturing articles for transportation over its road; nor hold land except such as is necessary to its business, but mining or manufacturing companies may carry their products over their own railroads or canals not exceeding fifty miles in length.

By the constitutions of California and Nebraska a board of railroad commissioners is established. By the constitution of Pennsylvania the secretary of internal affairs is given similar powers.

The constitutions of Arkansas and West Virginia make it the duty of every railroad in whole or in part in the state to make an annual report to the state auditor.

The constitution of Arkansas provides that all railroads shall be responsible for all damages to persons or property under such regulations as shall be prescribed by the Legislature, and that the Legislature shall require by suitable law the necessary means and appliances to secure the safety of passengers on railroads and other public conveyances.

By the Constitution of Colorado, it is unlawful for any railroad to require of its employees as a condition of their employment or otherwise, any contract or agreement where by the company is released from liability on account of personal injuries received by such employees while in its service by reason of the negligence of the company or its servants, and such contracts are void.

The constitution of Texas provides that for wilful neglect resulting in death, the company shall be liable to exemplary damages to the surviving husband, widow or heirs. By the constitutions of Arkansas and Pennsylvania no act of the legislature shall limit the amount to be recovered for injuries resulting in death or for injuries to person or property, and in case of death resulting, the right of action shall survive for the benefit of such persons as the Legislature may prescribe. That of Pennsylvania enacts that no statute shall prescribe any limitation of time within which such suits shall be brought against corporations different from those fixed for actions against natural persons.

By the constitutions of Colorado, Illinois, Missouri, Nebraska, New Jersey, New York, and Pennsylvania, the Legislature is prohibited from passing any private or special law giving to any person or corporation the right to lay railroad tracks.

The points concerning the examination of trainmen, which are brought up in the letter printed in another column, are worthy of attention. The reasons which this correspondent has, or thinks he has, for not doing what he fully believes ought to be done are typical ones. The belief that money cannot fairly be spent in this direction and that other duties must take precedence; the wish that some one else shall first set an example; these are, unfortunately, the sentiments of the majority of those who give any thought to this subject. But "Kentucky" must see that if a scheme of this kind is to be undertaken at all his suggestions of improvement in it are well nigh essential. The art of teaching must be cultivated; men must be trained to ask questions skillfully. There can be very good or very bad work done in this field as in others. An experienced teacher of youth or a lawyer skillful in cross-questioning could quickly tell trainmasters and superintendents numberless ways in which to save time and economize labor. Small roads, instead of waiting for larger ones to take the initiative, should combine their forces and work together. A properly qualified man, with all the points at his fingers' ends, could catechise the men of a half dozen small roads vastly better than could six men, one from each road, whose minds would be preoccupied with a hundred other matters. Besides, the large roads are not by any means sure to move as they ought. Even on the best ones where the duty of giving better supervision is recognized, the necessary help is not provided. Thousands of officers, small and great, are in the position of President Adams of the Union Pacific. They wish to give more attention to their subordinates (for the benefit of the employer, however, and not as a favor to the men as in Mr. Adams' case), but find "circumstances" violently pulling them in another direction.

An express passenger compound locomotive on Webb's system is now being built by Beyer, Peacock & Co., Manchester, Eng., for the Pennsylvania. It will be precisely similar to the compound engines now running the main line trains on the London & Northwestern. The two high pressure cylinders, 14 x 24, are outside connected and actuate the hind drivers, while the single low pressure cylinder is 30 in. diameter and 24 in. stroke, and is inside connected to the main drivers. The two pairs of drivers are not coupled and are 75 in. diameter. The boiler pressure is 175 lbs. per square inch. The economy obtained by this engine is probably largely due to the fact that it must always be worked compound, as the high pressure steam can never be admitted direct to the low pressure cylinders, and even when starting in full gear the engine works with about three-fold expansion. The leading end of the engine is carried on a single pair of 45 in. wheels with a radial motion controlled by springs.*

*A precisely similar engine was illustrated in the *Railroad Gazette*, Aug. 21, 1885.

The engine will be a purely English locomotive, without any change in design, as the Pennsylvania wish to have a locomotive with which they can experiment as to economy under the same conditions under which our American locomotives are run.

The strike on the Philadelphia & Reading the past week was ill-advised, and seems to have quickly gone to pieces from lack of unanimity of feeling among the men. In fact, the press dispatches would indicate that there was no authority anywhere to take any action except to furnish misinformation to the newspapers. The leaders, who ostensibly, and perhaps really, belong to the Knights of Labor, appear to be anything but railroad employees, and most of their methods are of a sort that the rank and file repudiate as soon as they see them in their true light.

Since 1877 the Brotherhood of Locomotive Engineers has been understood to have no following on the Reading, and it would naturally be assumed that the road was opposed to that organization; but the accounts state that the failure of the present strike was due to the large number of Brotherhood men who at once offered their services to the company.

A Cleveland correspondent calls our attention to an error of statement concerning the Auditors' Convention, Dec. 7. On page 812 we said that the resolution which virtually condemned junction settlements was rejected; we should have said that it was dropped or laid on the table. All the resolutions passed at the convention show on their face that auditors' settlements only were in mind when they were written; but the resolution concerning the entering of proportions on through bills was apparently dropped without action, so that junction settlements were neither condemned nor approved specifically. Our correspondent says that through bills with divisions shown on them are so common and so widely used that they (and inferentially, junction settlements) cannot be abolished. The convention, he intimates, approved the use of junction settlements where they are necessary, but the report does not show the fact.

NEW PUBLICATIONS.

Directory to the Iron and Steel Works of the United States, embracing a complete list of the Blast Furnaces, Rolling Mills, Steel Works, Forges and Bloomeries in every State and Territory; also Wire Mills, Wire Nail Works, Car Axle Works, Car Wheel Works, Car-Builders, Locomotive Works, Wrought-iron Pipe Works and Cast-iron Pipe Works. Corrected to November, 1887. Prepared and published by the American Iron and Steel Association, 261 South Fourth street, Philadelphia, Pa. Price, \$3.

This is the ninth edition of this directory, the last having been published in 1886, and the compilers state that it is the most complete of the series. The size of each furnace stack is given as well as the capacity of the works and kind of product. Under the rolling mills and steel works also is given information as to the product and capacity. There are lists of recently abandoned works. The net gain in the number of furnaces in the last fifteen months is but four, twenty having become inactive, and twenty-four having been built. Among the furnaces now put on the retired list is the Oxford Furnace, of New Jersey, which was built in 1742.

The annual capacity of the 582 active furnaces is given as 10,990,998 net tons, or 18,885 tons each. (These figures, however, are the returns of maximum capacity, under the most favorable circumstances, with all the furnaces in blast at once. In August, 1886, there were 423 completed rolling mills and steel works in the United States, and in November, 1887, there were 433. The number of puddling furnaces and heating furnaces has varied little, but the actual capacity of the rolling mills shows an increase of from 7,613,000 net tons to 8,265,000.

By this edition of the directory it appears that there were in November last 99 rolling mills and steel works in the country which use natural gas for fuel, either wholly or in part. In August, 1886, there were 68, and in September, 1884, there were but 6. Of the total number now using natural gas, 57 are in Pittsburgh and Allegheny County, Pa; 15 are in the western district of Pennsylvania, outside of Allegheny County; 7 in or near Wheeling, and 17 in Ohio. The territory in which are located the iron and steel works using natural gas extends as far east as Johnstown, 79 miles east of Pittsburgh.

The increase in standard Bessemer plants is shown by the following table:

	Sept., 1884.	Aug., 1886.	Nov., 1887.
Works built.....	20	27	35
No. of converters.....	45	58	74
Works building.....	..	13	3

The increase which has taken place in the past few years in this plant has been chiefly in addition to existing rolling mill plants of small converters for the production of steel for nail plate, wire billets, etc. Only three of the Bessemer works which have been completed since 1886 will roll part of their product into rails. The annual ingot capacity of the Bessemer works completed and building increased from 4,102,000 net tons in 1886 to 4,750,000 tons in 1887. Of the Clapp-Griffiths plant the increase has been from 13 converters in 1886 to 15 in 1887. It is noticeable that only 3 standard Bessemer steel plants are now building, and no new Clapp-Griffiths plants. The progress of the open-hearth steel furnace has been important. In 1886 there were 49 works completed and building with 99 furnaces, and those of 1887 comprise 104 furnaces. The ingot capacity in 1886 was 860,000 net tons, and in 1887 it was 815,000. The number of forges prepared to make wrought iron direct from the ore has decreased in the year from 50 to 38, and most of the forges and bloomeries are now idle.

The important changes particularly noted within the 15 years which have elapsed since the first edition of the direc-

tory was published are in the development of the Bessemer steel industry; the almost complete substitution of steel rails for iron; the creation of the open-hearth steel industry, and the wide substitution of bituminous coke for anthracite coal and charcoal in the manufacture of pig iron. The changes which have taken place in the territorial distribution of the iron and steel industries chiefly affect New England, Tennessee and Alabama. Manufacture of rolled iron has declined in New England, while, of course, the activity in the building of coke furnaces in Tennessee and Alabama has been very great. Whereas, in 1873 there were scarcely half a dozen coke furnaces in these states, now there are 23 completed and 18 building, most of which are large and equipped with modern improvements.

TECHNICAL.

The Car Shops.

In addition to the 3,900 freight cars reported in the *Railroad Gazette* of last week as being ordered by the Chicago & Northwestern, 500 more have been contracted for with the Wells & French Co.

The Michigan Salt Association has ordered of the Michigan Car Co. 125 cars, each of 50,000 lbs. capacity, to be finished Feb. 1.

The Indianapolis Car Works have received a contract for 200 cars for the Pittsburgh & Western.

The New York Central & Hudson River has awarded a contract for 25 passenger cars to the Gilbert Car Co., of Troy, N. Y., to be equipped with the Martin heater.

The Pittsburgh & Western has ordered 200 coal cars of the Ohio Falls Car Co., 400 of the Youngstown Car Co., and 400 of the Indianapolis Car Co.

The Georgia Pacific has ordered 100 box, 100 drop bottom coal and 100 gondola cars of the Tredegar Co., Richmond, Va.; 50 coke, 50 flats and 10 cabooses of the Alabama Car Works, Anniston, Ala.; 10 Blaine dump cars of the Barney & Smith Co., and 4 freight locomotives of the New York Locomotive Works, Rome, N. Y.

Bridge Notes.

Sealed proposals will be received at the office of the City Engineer at Kansas City, Mo., until Jan. 28, for erecting an iron viaduct 900 ft. in length. The work will be paid for in cash. A certified check for \$200 must accompany each bid. Address John Donnelly, City Engineer.

Sealed proposals will be received by the Board of Commissioners of Craven County at New Berne, S. C., until Feb. 6, for the construction of a bridge across the Neuse River at a point within two miles of New Berne.

The Trenton Iron Works, of Trenton, N. J., has been awarded the contract to build an iron bridge at Borden-town.

R. Jackson has been awarded the contract to build a bridge at Denver, Col.

The Berlin Iron Bridge Co., of East Berlin, Conn., has been awarded the contract for the erection of a bridge at Columbia.

The Edge Moor Bridge Co., of Wilmington, Del., has been awarded the contract to build a bridge at Council Bluffs, Ia. The county commissioners will build a bridge at Chicopee, Mass.

The county commissioners will build a bridge at McConnellsburg, Pa. Address J. E. Downs.

The Pennsylvania Railroad will build a bridge between Riverside and Danville, Pa.

The county commissioners will build a bridge at Dublin, Ga.

The county commissioners will build a bridge at La Crosse, Wis.

The Philadelphia, Wilmington & Baltimore will build a bridge at Laurel, Del.

The St. Paul, Minneapolis & Manitoba will build a bridge at Great Falls, Mont. C. Shields, Minot, Dak., Superintendent.

The county commissioners will build a bridge at Steubenville, W. Va.

The county commissioners of Cumberland County will build an iron bridge. Address R. J. Latta, Fayetteville, N. C.

The county commissioners will build a bridge at Dunnville, Wis.

The county commissioners will build a bridge at Eau Claire, Wis.

Manufacturing and Business.

Chas. W. Melcher, of St. Louis, has sold a 150 horse-power Berryman feed water heater to the Springfield Electric Light Co.

Baxley & Freeman, Baxley & Bowles and John H. Baxley, of Montgomery, Ala., have consolidated. They have been awarded the contract to furnish 110,000 sleepers for the Mobile & Birmingham.

The Heine Safety Boiler Co. have just shipped a 300 horse-power boiler, weighing 25,000 pounds, to the Chicago Edison Station, Chicago. Other recent sales of the company embrace a 300 horse-power boiler to the Columbus (O.) Electric Light Co.—to supplement a Heine boiler of 150 horse-power, sold a year ago—and two boilers of 200 horse-power to Texas.

The first piece of belting made with wire has been manufactured at Beaver Falls, Pa., by J. E. Emerson and Thomas Midgely, under patents taken out by the latter. The piece is 40 ft. long and 4 in. wide, and is made from No. 20 steel wire. It is as pliable as leather, in fact more so, and will wrap around a 1 or 2-in. shaft without straining the wire.

Messrs. Lindsay, Parvin & Co., Philadelphia, give notice that, "on account of the continued growth of our business we shall remove on Jan. 1 to offices in the new Bullitt building, 133 South 4th street.

Iron and Steel.

The new Bessemer steel works of the Old Dominion Iron & Nail Works, at Richmond, Va., have been blown in. They consist of two three ton Bessemer converters and a blooming mill, and the steel will be used in the production of slabs and billets and nails.

The Eastern Forge Co. works at East Deering, Me., were burned on the 15th inst. The company was making car axles, and had orders ahead for all winter.

A company is being organized for the purpose of re-opening the Laclede Rolling Mills, at St. Louis.

The Hewes & Phillips Iron Works, Newark, N. J., are very busy, both in their engine and boiler departments. They are at the present time building several of their large compound engines, as well as several of the Manning boilers for New England mills.

The Pine Mountain Iron & Coal Co., capital stock \$2,000,000, has been incorporated by J. D. Reed, H. S. Barker and others in Louisville, Ky.

The Steelton, Pa., Register says of the Pennsylvania Steel Works at that place: "An experimental mill will be erected in the near future. The mill will be built on the same style as the new billet mill, and will be 75 ft. square. The castings made from open-hearth steel will likely be made in the

new building. Work on the new billet mill is progressing satisfactorily and will be ready to start early in the new year. Additional machinery will be added to the rail mill as soon as time can be spared to close the mill.

According to the Wellston (O.) *Argus*, industries are to be established at that place as follows: two blast furnaces of 150 tons daily capacity; one steel plant, 150 tons capacity; one steel nail plant, 2,000 kegs capacity; one nail plate rolling mill, capacity 150 tons daily; one wire nail mill plant, capacity 800 kegs daily; one wire rolling mill, capacity to supply the above wire nail mill; one stove foundry, capacity 100 stoves daily; one pipe foundry, 50 tons daily capacity, and T rail, bar and guide mill.

The Rail Market.

Steel Rails.—The market is dull, with no sales of consequence reported. Quotations, \$31.50 to \$33 for standard sections.

Car Heating Notes.

As is well known, the Gold system of continuous heating provides a means of keeping a car warm for some hours after the engine is detached. The sealed reservoir of salt water will not, however, keep the car hot for an indefinite time, though as the salt water, even if frozen by zero weather, cannot burst the pipe, it is difficult to see what harm it will result, even if the cars were allowed to stand without further attention, especially as the steam pipes are drained of condensed water by traps.

The Providence, Warren & Bristol, however, which uses the Gold system exclusively, has a simple and very effective arrangement for keeping cars heated when standing for any length of time at Bristol, the terminus of the line. Four hundred feet from the car shed is the engine-house, where at least one engine is kept under steam nightly for use in case of emergency. Connection is made from the heater pipe of this engine to a main to the car-house laid below the frost line. Here pipes run along by each track and connections are made with the cars by the ordinary couplings.

The New York & New England is beginning to equip its cars with the New York Safety system of steam heating, but Mr. Jackson, the General Superintendent, substitutes the Westinghouse brake coupling for the above-platform device of the Safety Co.

Aluminum Bronze for Castings.

In view of the importance of finding a substitute in cast metal for wrought steel and iron as supplied to the complex parts of modern marine engines, the engineer officers of the Navy are much interested in the result of recent comparative tests of common and aluminum bronze at the Watertown Arsenal. The tests of ordinary bronze showed a tensile strength of 24,500 lbs. per square in., with an elongation of 8.2 per cent. The aluminum bronze known commercially as "A. 3" cast in sand exhibited a tensile strength of 53,000 pounds and an elongation of 6.2 per cent., while the same metal cast in chilled moulds resisted a strain of 67,600 pounds to the square inch, with a total elongation of 13 per cent. In the opinion of naval experts these results show that the aluminum bronze compares so favorably with steel and wrought iron that the last-named metals will be displaced to a considerable extent in engine building, the greater cost of the bronze being overcome by the ease with which it can be cast into intricate patterns.

FOREIGN TECHNICAL NOTES.

Honigman's Soda Locomotive.

This appliance, which has been illustrated and described in these columns,* and was used for some months on the Minneapolis, Lyndale & Minnetonka, has been lately improved and simplified in order to reduce the weight and cost of the boiler, which were objectionable. A boiler of the improved form is used in constructing the Busalla tunnel, on the line between Turin and Genoa. Only one high pressure stationary boiler is required, and it may be also used for other purposes. The locomotive boiler is of the usual type, and has at its two ends two water compartments which are connected together by pipes passing through the soda compartment. The shell and ends of the water compartments are of steel as in former boilers, while the cylindrical middle compartment, tube and tube plates are of copper. The only novelty in the boiler consists of a steam chamber in one of the water compartments, with a steam valve and small pipes which lead from this chamber into the connecting pipes inside the boiler. At the station a connection is made between the steam boiler and this steam chamber, and by the introduction of high pressure steam a lively circulation is caused in the connecting tubes, which, together with the rising temperature of the water, cause a speedy evaporation of the liquid in the soda compartment, which, when the solution consists of three parts soda in two parts water reaches boiling point at 329° Fah., giving a pressure of 85 lbs. per sq. in. The soda solution is thus never drawn out of the boiler and this greatly simplifies the operation of the soda locomotive.

Belt and Leather Grease.

The German Car-Builders recommend the following mixture: Melt three parts common soap with one part palm oil and add to the mixture four parts ammonia soap (which is obtained by saturating oil soap with carbonate of ammonia) and 1½ parts of a tannin solution obtained by dissolving sixteen parts tannic acid in four parts water. The whole mixture is thoroughly mixed, and can be kept for a long time in closed stone jars. When this mixture is applied to the leather, care should be taken not to use too much of it, but just sufficient to saturate the leather.

Apparatus for Preserving Ties.

The following method of impregnating railroad ties so as to increase their durability has been patented in Germany by Mr. Lowenfeld. The ties are soaked for one hour in a solution of chloride of zinc at a pressure of 40 lbs. per sq. in., then left for one hour in vacuum and again soaked for three hours under a pressure of 105 lbs. per sq. in. In order to make the process a continuous one six boilers are placed on rollers along a large tank which contains the soaking liquid. On the opposite side of the tank is a movable engine, provided with cold water, pressure and air pumps and three pipes connecting with the air and pressure pumps and the steam dome. The pressure pump also connects with the reservoir holding the solution. The boilers are worked in succession, one being filled while the other is emptied and so on. Each of these boilers is provided with a pipe, connecting with the tank and a pipe for the entrance of air. Five pipes connecting each with the other five boilers are also provided, which can be closed at will so as to work them all together or singly.

The work proceeds as follows: Each operation is made in each boiler successively and in their regular order. When steam is turned off the first boiler, the steam is led into the second, while the air pump exhausts the air in the first boiler. The soaking solution is made to pass from the first into the second boiler, and so on. After the last three hours' soaking in the first boiler the liquid is turned into the second, and by means of a floating valve the connection of this with the air pump becomes closed automatically.

Technical Attachés.

Germany has for some time made it a regular practice to keep at her embassies and legations regularly appointed technical attachés whose duties in the technical line are about the same as those of military attachés in their respective line. Other European countries have done the same, although the technical attaché has not yet been recognized generally as a diplomatic necessity. Russia now proposes to imitate other countries, and as a first step, will, according to the reports of Russian papers, soon send an engineer as attaché to the Washington legation, whose duty will be to furnish his government regular reports on the progress of technical matters in this country.

Arbel's Disk Wheel.

In the works at Rive de Gier (France) spoke wheels after Arbel's patent have been manufactured for some time. All the parts of the wheel are first produced separately, then put together, heated and welded together under the hammer or the press. So far only spoke wheels had been manufactured by this method, but lately the manufacture of disk wheels with spoke ribs has also been undertaken by the same method. The different parts, centre, spokes, etc., are welded together as for spoke wheels in the first heat, then disk sections are placed between the spokes in special grooves, or a whole disk is placed in the inside circumference of the wheel, and the whole again heated and welded, a disk wheel being thus obtained in which the spokes are ribs of the disk. The welding is effected between stamps or dies under a powerful steam hammer.

Removing Rust.

According to a French scientific paper, "Steel or iron can be freed from rust, regaining its original polish, by the following method: Mix 15 parts prussiate of potash, 15 parts fat soap, 30 parts chalk with water to a thick paste. Dampen first the rusty portions with a solution of prussiate of potash in double its weight of water, and then rub the spots with the above mixture.

Electric Light in Germany.

Official statistics show the number of electric lights in Germany to be not less than 15,000 arc and 170,000 incandescent lamps, with 4,000 dynamos. The estimated power used for all these lamps is about 30,000 h. p. One single firm in Berlin manufactures 2,000 incandescent lamps daily and intend to increase the facilities so as to produce 5,000 lights of all sorts daily.

Street-car Trains.

The Western of Switzerland has decided to run "street-car trains" between Geneva and Nyon, on the plan adopted in various parts of France and Belgium. The trains, of which there will be five per day, will run in between the regular existing service, will travel slowly, and stop to take up passengers at any point of the line. The object of this innovation is to prevent the formation of a parallel street-car line which would compete with the existing railway.

The average American, however averse to walking, would hardly wait two hours for a street-car to come along.

German Freight Cars.

The German railroad authorities have under consideration a proposal to build larger freight cars, with a view to afford producers, especially colliery owners and iron masters, the relief they ask for in the matter of rates of carriage, without diminishing the profits of the carriage of these goods. It is proposed to use cars having a carrying capacity of from 20 to 30 tons, in place of the present 10-ton cars. The question was mooted a year ago, and has been forced on the attention of the railroad authorities by manufacturers of all classes.

Canal for Birmingham, England.

Birmingham, as was some time since explained in the *Railroad Gazette*, is dependent on railroads and very small canal boats for freighting connections with the sea, and it has been proposed to so enlarge the canals leading toward the Severn that boats of 200 tons burden may pass, but as the contemplated project involved the enlargement of several tunnels, it still remains a project. It is now proposed to build a short canal 7 to 9 ft. deep and 80 ft. wide between Birmingham and the River Trent, which will give an outlet to the North Sea instead of toward the Atlantic. It is proposed to tow the barges by steam tugs, and the cost of freighting by this mode, a distance of 170 miles, it is hoped, will not be over 8 shillings per ton, or almost exactly 1 cent per ton mile, about the average railroad freight rates in this country; the project does not at first look inviting, but *The Engineer* estimates that these reduced rates will effect a saving on merchandise and raw materials of £300,000 a year over the present rates.

THE SCRAP HEAP.

A Mill Engine Stands Fire.

A very singular incident was noted in connection with a recent mill fire in Carlton, Mich. The building was burning fiercely, but the big engine which drove the machinery continued to run all through the blaze, and by that means was saved from destruction, though there was not a wall standing on any side of it when the fire had finished. The pump was also running, and kept the boiler supplied so there could be no explosion. It was a peculiar spectacle to see the engine driving away at a slashing speed in the midst of the flames, but the motion somehow saved it from fire. All the rest of the machinery was a total loss.

Another Big Tender.

A country paper states that the municipal authorities of Westfield, Mass., are complaining that the locomotives of the New Haven & Northampton are using so much water that the pressure in the pipes is suddenly reduced from 125 lbs. to 40 lbs. per sq. in., while the tender tank is filling. As our contemporary states that "the average amount drawn by each locomotive was 12,000 gallons, and that this was done in about three minutes," it is not surprising that the consequent sudden change of pressure cracks pipes and produces confusion in the average Westfield household. The New Haven & Northampton are probably meditating an extension into a "dry" state, and hence these big tenders.

The Wild West.

A man in Missouri has patented bullet-proof express car.

No Radical Difference.

First thief—Hello, Bill, still burglarin'?
Second thief—No, I've found something safer than that.
"Eh? What yer doin' now?"
"Runnin' a railroad restaurant."—*Omaha World*.

Conviction of an Express Messenger.

George Alden Bennett was a messenger in the employ of the Pacific Express Co., Salt Lake Division, and was bonded by the American Surety Co., of New York. About Aug. 13 last he embezzled a money package of \$10,000. He was captured and \$8,000 recovered. The American Surety Co. having been notified, promptly paid its liability and forthwith detailed two of its inspectors, who, in conjunction with

Superintendent Gentsch, made a case for prosecution. Nov. 19 Bennett was convicted, and on the 6th inst. he was sentenced to imprisonment in the penitentiary at Boise City, Idaho, for the period of 10 years.

An Astute Express Messenger.

John Grimshaw, the Pacific express messenger whose car was attacked by robbers on Dec. 25 in the Indian Territory, describes the experience as follows:

"The glim was doused, and I at once began hiding the money that was in my custody. I was not particular where I placed it, but threw it here, there and everywhere. In the meantime the robbers were calling on me to open up, but I paid no attention to them. I had only a .38-calibre five-shooter with which to defend myself. The baggage master was without a weapon of any kind. We had several boxes filled with meat in the car, and we piled these in such a position as to form a sort of breastwork, and took our position between them. We had a small phial of snake bite preventive with us, and we took a pull of it to brace us up. Then we awaited developments while a perfect volley of cannonading was going on outside. The doors were filled full of bullets, and then an effort was made to batter them in, but all to no purpose. I will admit that I was frightened, but I believe the robbers were as badly frightened as we were. There were seven or eight men in the party, but only one person gave orders, and I feel satisfied that I would recognize his voice if I didn't hear it again for 10 years.

"I am satisfied in my own mind that the attacking party resides in the neighborhood of Springtown, one of the toughest holes in existence. We were due to pass a train at Atoka and were in danger of being run into from both front and rear, as there was a freight train following us only a short distance. It was a close call, and you can rest assured that Sparrow and I breathed considerably easier when the train pulled out without the car having been fired or robbed."

Railroad Construction in the Southwest.

During the year 1887 the new mileage actually constructed on railroads in the Southwest aggregates 4,356 miles, as follows: Atchison, Topeka & Santa Fe, 1,368; Missouri Pacific, 1,266; Chicago, Rock Island & Pacific, 1,200; Kansas City, Fort Scott & Gulf, 366; Kansas City, Wyandotte & Northwestern, 90; Kansas City & Southern, 45; Union Pacific, 21; total, 4,356. The most of this work has been done in Kansas, Indian Territory, Texas, Colorado and Nebraska, although the Santa Fe's new line to Chicago is included. The construction in Kansas is far ahead of that in any other state.

Logging Roads for Northern Minnesota.

A dispatch from Duluth, Minn., states that preparations are being made by a number of leading logging companies on the St. Louis River to thoroughly gridiron the immense tract of pine-bearing territory north of Cloquet with a system of railroads, one or more lines of which will be carefully graded and laid with heavy rails, to be used also as a general freight and passenger road, leading to points on the lower Vermilion iron range. The project has been brought about by frequent expensive and vexatious delays incident to low water, scarcity of snow, etc., from which the mill-men and loggers have suffered. The pine tracts are scarcely touched as yet, and nearly 3,000,000,000 ft. of timber is standing in the district to be pierced by the roads.

RAILROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

An Alabama statute (acts 1886-7, pp. 87, 89) entitled "An act for the protection of the traveling public against accidents caused by color blindness and defective vision," requires certain railroad employees employed in specified capacities to submit to examination by a medical examiner appointed by the governor, and obtain a certificate as to their freedom from color blindness or other defect of vision, which examination shall be made at the expense of the railroad company in whose employment the applicant is. A conductor applied to the examiner to make the examination in his case, but he refused until he was paid his fee either by the conductor or the railroad. The Supreme Court holds that this is no ground for refusal; the examiner must make the examination; he cannot hold the employee for the fee; he cannot demand it from the railroad in advance, but he may collect it from the latter when he has performed the service.

Another statute in the same state requires all railroad engineers engaged in running a train of cars or engine used for the transportation of persons, passengers or freight on the main line of any railroad in this state, to be examined and licensed by a board appointed by the governor, and makes it a misdemeanor, punishable by fine and hard labor, for any engineer to act in that capacity without such examination and license. The Supreme Court rules that the statute is constitutional; it is not a "regulation of commerce," but an exercise of the police power of the state.

The Supreme Court of Arkansas holds that a provision in the charter of a railroad corporation, that the rate of transportation for each passenger should not exceed five cents per mile, is not a contract by the state with the corporation that the passenger fare should never be reduced below that rate, and that a statute which, for the purpose of fixing rates of charges, divides railroads into classes, according to their lengths, operates uniformly on each class. The Supreme Court also decides in the same case that the privileges conferred upon a railroad corporation under a special charter do not pass to the purchasers under a mortgage foreclosure sale, although the mortgage purports to transfer the charter; and the reorganization by such purchasers is the formation of a new corporation, subject to the laws in force at the time of the reorganization.

In Colorado a railroad company was empowered by special act of Congress to take timber from public lands adjacent to its right of way for the repair and construction of its road, with the proviso that the road should be built to a certain point within a certain time. Having forfeited its rights under the special act, it continued to take timber, and, upon being sued by the government for the value of the timber taken after such forfeiture, justified its action under the provision of a subsequent general act of Congress giving railroad companies generally a right of way over public lands, and the privilege of taking material therefrom for the construction of their roads. The United States District Court holds that the two acts were not inconsistent, and that the defendant, having enjoyed the bounty of the special act, was not thereby disqualified from claiming the privileges granted by the general law. The Court also holds that the word "adjacent" in the act covers such timber and other materials as could be conveniently reached by ordinary transportation by wagons, and that the privilege granted did not include the right to take timber from public lands, and transport it by rail to distant parts of the road, for use in construction and repairs.

In Louisiana the United States Circuit Court, in answer to the petition of the receivers of a railroad, asking for information as to the construction of Sec. 4 of the Inter-state Commerce law, relating to the long and short haul, replies that where the circumstances and conditions are dissimilar there is no prohibition; where the circumstances and condi-

* See *Railroad Gazette*, July 3, 1886.

tions are similar the prohibition attaches, and that where it is difficult to point out clearly the circumstance or condition which produces dissimilarity the doubt should go in favor of the object of the law, and the circumstances and conditions should be taken as substantially similar. Where the circumstances and conditions are similar, or substantially similar, and the result to the carrier is injurious, relief can be had only through the Commission.⁵

Carriage of Goods and Injuries to Property.

In Louisiana the United States Circuit Court rules that a shipper's order calling for a specific number of cars for a specified day does not until accepted by the carrier constitute a contract binding on either.⁶ In California the United States Circuit Court decides that where a shipper attaches his bill of lading to a draft upon the consignee he thereby expresses his intention to deliver the goods upon payment of such draft, and to retain control of them until such payment, and the carrier who, under such circumstances, delivers them while in transit to the shipper, is liable to the consignee who has duly taken up the draft. The Court also holds in this case that under the California statute, providing that, in an action brought by a consignee against a carrier for wrongfully delivering up goods in transit to a party other than the consignee, the measure of damages shall be the highest market value of the property at any time between the conversion and the verdict, without interest, and a fair compensation for the time and money properly expended in pursuit of the property, it is incumbent on the plaintiff to show the circumstances under which the expenditure claimed by him to have been incurred was made, so that the Court can decide whether it was proper.⁷

In Iowa the Supreme Court holds that the damages given by the code of that state (\$464) to abutting owners of land for injury to the property caused by construction of a railroad, being full and permanent, there can be but one recovery, and that only in favor of the abutter who owned the property when the road was built, or the assignee of his claim. A purchaser from such abutter, under a warranty deed, who bought after the road was put in operation, cannot recover.⁸

In Minnesota the Supreme Court rules that in actions of this kind evidence that the land, a part only of which is taken, is so near to the railroad depot and stockyards as to show that the land will be subject to extraordinary use on that account, is admissible, and, as affecting the market value of the property, the fact may be shown that the railroad increases the rate of insurance upon buildings already erected.⁹

In Florida the Supreme Court denies the right of the Court to condemn the roadbed of one railroad corporation for the use of another. The Legislature, though, may do it.¹⁰ In Washington Territory a railroad company eleven days after it commenced to construct its road through certain lands obtained an assignment of a contract by which the owner agreed to convey a strip of land to another company, in consideration of its building its road between certain points. The Supreme Court holds that the right of the owner to compensation accrued when the company entered upon the land, and that, having entered and built its road without reference to the agreement in question, the company could not claim any right thereunder to have the land conveyed, which it had already appropriated under the power of eminent domain, and the land-owner was not estopped from claiming compensation by his previous contract, the company having acted independently, and not upon the faith of the contract, which was not assigned to it until after its road was commenced.¹¹

In Minnesota the Supreme Court holds that the rule established by it in former cases, that in case of an animal trespassing on the track of a railroad company, without the fault of the company, there is no duty of watchfulness on the part of those in charge of its trains to ascertain if the animal be there, and that their duty of care with respect to it arises only upon their discovering its peril, applies as well in the case of an animal wrongfully upon a highway at a railroad crossing.¹²

In Louisiana a fire started on the land of an adjoining owner shortly after a train had passed. The Federal Court rules that the presumption is that the locomotive was the cause, and the road is responsible for the damage.¹³

Injuries to Passengers, Employees and Strangers.

In Iowa a passenger entered a car, having in a pocket of his overcoat a sum of money, and gave the overcoat to the porter without mentioning the money, and the porter hung the coat in the passenger's berth. He was taking the money to give to his brother to invest, and he had on his person sufficient other money for his traveling expenses. The Supreme Court decides that the money was in his own custody and at his risk; and the fact that soon afterwards an accident overturned the car, and on his making his way out he told the porter and the brakeman of the railway company that the money was in the car, put no liability on the company as gratuitous bailee or otherwise, and it was not in such case responsible for the money.¹⁴

In Louisiana a man walking on an elevated plank walk constructed alongside of the track at a station for the use of passengers and the public heard a train approaching behind him, and moved to the middle of the walk, where he would have been safe from being struck by any passing car of the ordinary width. The approaching train, however, was a construction train of peculiar build, having its brakes attached to the side of the cars instead of at the ends, and thus causing the brake-wheels to project some 14 in. beyond the edge of the car. This wheel, being of the height of plaintiff's head, struck him as the train passed, and knocked him senseless, inflicting severe injuries. The Supreme Court holds that plaintiff had the right to be on the walk, and to suppose himself in safety while occupying it at a point beyond the projection of all ordinary trains, and that he was guilty of no negligence. The Supreme Court therefore affirms a judgment against the railroad for \$100 by increasing it to \$500.¹⁵

In Alabama a man walking on a path near the track and on the right of way of the railroad was injured by being hit by a cow, which, being on the track, was struck by the train and thrown in the air. The Supreme Court holds the road liable, and lays it down that to walk on a railroad right of way does not make a man a trespasser so as to render him remediless in case of injury while there.¹⁶

In California, in an action for the negligent killing of a person at a railroad crossing, it appeared that the railroad track at the place of the occurrence was unobstructed and in plain view of the highway along which deceased was approaching the crossing; that deceased was a man in the full possession of all his faculties, active, sober, cautious and fully acquainted with the usual time that trains passed over the road; that the train that killed him was going south, was a special train and unexpected at the station just north of the crossing. No evidence showed that the train made any signal of warning before passing the crossing. It made a loud noise in its course, and the track along which it passed was near and in sight of the highway along which deceased was driving for some distance before they crossed. There was no evidence whatever of the manner of the collision nor of the circumstances before or connected with it. The wind was from the north, there was no smoke, dust or other obstruction to a fair view of the track. The engineers had been in the habit of passing this crossing without the usual signals,

and defendant was aware of the habit. The Supreme Court holds that deceased, by failing to use the faculties and opportunities of observation which he had, was guilty of contributory negligence, and the railroad was not liable in damages.¹⁷ In Washington Territory in a similar action to recover for injuries received at a crossing, the plaintiff's testimony showed that he was driving two horses, which were gentle and manageable, on a street which crossed the railroad at nearly right angles in defendant's switch yard; that north of the main track, five or six feet from and parallel with it, was a side track of considerable length; that plaintiff approached the crossing on the north side, and, when about 60 feet away, a train (not a regular one) passed rapidly, and went out of sight behind some box cars that were standing on the side track to the east of the street, and partly obstructing it; that eastward of the street, on the north side, was a depot, with a platform on its west; that the crossing was planked, the planking extending along the end of the depot platform the width of the street, and about 30 feet from the main track; that just before going on the planking he slowed up to a walk; that the yard master was at a switch on the opposite side of the main track; that, as soon as the train passed, two wagons started from the opposite side, where they had been waiting, and crossed, passing him, all being on the planking at once; that, without stopping or speaking to any one, he kept his horses going at a walk, not bearing any bell, whistle, or other noise of a train, though listening, until, just as he got by the end of the box cars, he saw the train close on him; that he whipped up his horses on the main track, and, as they sprang forward, he heard a cracking noise, and knew no more until in the doctor's hands. It further appeared that plaintiff had lived in the town some time, and had worked for the railroad at its car-shops nearly a year; was well acquainted with the crossing, and knew that they switched cars there; that he was familiar with the switch-yard, and knew the location of the switches. The Supreme Court on this evidence rules that his negligence contributed to the injury, and he cannot recover anything from the railroad.¹⁸

- ¹ Baldwin v. Kouns, 2 South. Rep., 638.
- ² McDonald v. State, 2 South. Rep., 829.
- ³ Dow v. Beideman, 5 S. W. Rep., 97.
- ⁴ U. S. v. Denver & S. R. Co., 31 Fed. R. p. 886.
- ⁵ Mo. Pac. R. Co. v. T. & P. R. Co., 31 Fed. Rep., 862.
- ⁶ Re Davis, 31 Fed. Rep., 864.
- ⁷ Wells v. Oregon R. & N. Co., 32 Fed. Rep., 51.
- ⁸ Pratt v. Des Moines N. W. R. Co., 33 N. W. Rep., 666.
- ⁹ C. R. I. & N. W. R. Co. v. Raymond, 33 N. W. Rep., 704.
- ¹⁰ Armistead v. J. S. & A. R. Co., 2 South. Rep., 710.
- ¹¹ Oregon R. & Nav. Co. v. Day, 14 Pac. Rep., 583.
- ¹² Palmer v. North. Pac. R. Co., 33 N. W. Rep., 707.
- ¹³ Mo. Pac. R. Co. v. Fagan, 31 Fed. Rep., 526.
- ¹⁴ Hillis v. Chicago, R. I. & P. R. Co., 33 N. W. Rep., 643.
- ¹⁵ Sullivan v. Vicksburg, S. & P. R. Co., 2 South. Rep., 586.
- ¹⁶ Alabama G. S. R. Co. v. Chapman, 2 South. Rep., 738.
- ¹⁷ Glascock v. Cent. Pac. R. Co., 14 Pac. Rep., 518.
- ¹⁸ North Pac. R. Co. v. Holmes, 14 Pac. Rep., 588.

General Railroad News.

MEETINGS AND ANNOUNCEMENTS.

Meetings of the stockholders of railroad companies will be held as follows:

- Georgia Company, annual meeting, at the office, High Point, Guilford County, N. C., Jan. 10.
- Cleveland & Pittsburgh, annual meeting, at the office, Cleveland, O., Jan. 4.
- Manhattan, special meeting, at the office, New York, Jan. 10.

Railroad and Technical Conventions.

Meetings and conventions of railroad associations and technical societies will be held as follows:

- The Western Society of Engineers holds its regular meetings at its hall, No. 15 Washington street, Chicago, at 7:30 p. m., on the first Tuesday of each month.
- The New England Railway Club meets at its rooms in the Boston & Albany passenger station, Boston, on the second Wednesday of each month.
- The Boston Society of Civil Engineers holds its regular monthly meetings at its rooms in the Boston & Albany station, Boston, at 7:30 p. m. on the third Wednesday of each month.
- The New York Railroad Club meets at its rooms, 113 Liberty street, New York City, on the third Thursday of each month.
- The Western Railway Club meets in Chicago the third Wednesday in each month.
- The Engineers' Club of St. Louis meets the first and third Wednesday of each month till June.
- The Central Railway Club meets at the Tift House, Buffalo, the fourth Wednesday of January, March, May, August and October.
- The General Time Convention, semi-annual meeting, will be held in New York, April 11.
- The National Association of General Baggage Agents holds its seventh annual convention at the Grand Pacific Hotel, Chicago, Jan. 18.
- The National Association of General Passenger and Ticket Agents holds its annual meeting in St. Augustine, Fla., on March 20.
- The Traveling Passenger Agents' Association holds its annual meeting in Jacksonville, Fla., on Jan. 10.
- The American Society of Civil Engineers holds meetings on the first and third Wednesday in each month at the House of the Society, 127 East Twenty-third street, New York.
- The Ohio Society of Surveyors and Civil Engineers will hold its ninth annual meeting in Lyndon Hall, Columbus, O., on Jan. 10 11 and 12.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

- Central Pacific, 1 per cent., payable Feb. 1.
- Chicago, Rock Island & Pacific, quarterly, 1½ per cent., payable Feb. 1.
- Long Island, 1 per cent., payable Feb. 2.

Engineers' Club of St. Louis.

The 283d meeting was held Dec. 21. The result of the ballot for officers was announced as follows: President, M. L. Holman; Vice-President, J. A. Ackerson; Librarian, J. B. Johnson; Secretary, W. H. Bryan; Treasurer, C. W. Melcher; Directors, W. R. Potter and F. E. Knipser. Professor Potter, the retiring president, made a brief address on the present status of the profession and of this club in particular. His remarks were largely historical, and he suggested celebrating the twentieth anniversary of the club Nov. 4, 1888.

The secretary read a paper by Mr. I. A. Smith, on Rapid Railroad Embankment Construction, being an account of the construction of an embankment in North St. Louis containing 97,500 cubic yards within a period of 18 days. The material was river silt, and the cost 18.58 cents per cubic yard, which was little more than half of the lowest bid

received from contractors, none of whom would give a time guarantee. In the discussion which followed it was shown that the shrinkage six months after the bank was built was 11 per cent.

Professor Engler showed an ingenious model of the hyperboloid revolution.

New England Order of Railroad Conductors.

At the meeting of the New England Division, No. 157, Order of Railroad Conductors in Boston last week, the following officers were elected for the ensuing year: C. C., A. O. Brown, Old Colony; A. C. C., G. F. Towne, Fitchburg; S. and T., C. F. Hammond, Old Colony; Sr. C., John W. Tower, Old Colony; Jr. C., W. H. Hogue, Boston & Maine; I. S., C. H. Ingalls, New York & New England; O. S., W. W. Prance, Boston & Providence; Delegate to the Grand Division, C. F. Hammond; Division Committee, H. E. Strout, Boston & Providence, Lewis Holmes, New York & New England, J. J. Thompson, Boston & Maine.

United States Naval Institute, Newport Branch.

A meeting of this Branch will be held at the Torpedo Station, Wednesday evening, Feb. 1, 1888, for the discussion of a paper by Mr. Alfred H. Cowles, on Aluminum Bronze for Heavy Guns. This meeting is a continuation of the one held at Annapolis, Md., Oct. 27, 1887, the results of which are published in the *Proceedings of the Naval Institute*, Volume 13, No. 4, December, 1887. Mr. Cowles will be present to review the criticisms passed upon his original paper, to present fresh data obtained since the previous meeting, and to exhibit specimens of the products of the electrical furnace. Contributions to the discussion have already been received from George Allan, M. Inst. C. E., and M. Henri Brivet, while others are expected.

Boston Society of Civil Engineers.

A regular meeting was held Dec. 21. Charles E. C. Breck was elected a member of the Society. A vote of thanks was passed to A. V. Abbott, Chief Engineer of the National Superheated Water Co., for the description of the plant of the Boston Heating Co., which he gave the Society at the last meeting. Authority was given for the appointment of a committee of five to represent the Society at the approaching meeting of the American Institute of Mining Engineers, in Boston, and to extend to the members of the Institute such courtesies as may be found expedient. A paper by George A. Ellis was read, giving a description of the Racine water-works. N. M. Tidd gave an informal talk on the construction of dry docks, with special reference to the wooden docks built by Mr. Simpson in East Boston and Brooklyn.

Western Society of Engineers.

The 242d meeting was held Dec. 6, 1887. The committee appointed by the President to take steps toward the due recognition of the services of Mr. Moorehouse to the Society, and to nominate a successor as Secretary, made a report, in accordance with which resolutions were adopted as follows: That Mr. Moorehouse be elected an honorary member of the Society; that a vote of thanks be passed for his faithful services, extending over a period of 18 years, and that a supper be given in his honor on the evening of the next annual meeting.

Prof. L. E. Cooley was elected Secretary. Papers were presented by Mr. Fiend on "Contouring," and by Gen. M. B. Hewson on "Hints on Drainage."

Memphis Superintendents' Association.

The roads centering in Memphis, Tenn., have formed an association with the name of the Railway Superintendents' Association of Memphis. Its object is the securing of co-operation and unanimity of action on the part of the railroads running into Memphis, in the transfer and interchange of business, and generally for the regulation and good conduct of all transportation matters in which said lines are interested. The managers, superintendents and assistant superintendents of all Memphis railroads are eligible to membership. Meetings will be held the third Tuesday of each month at 4 p. m. The following companies are members of the association: Kansas City, Memphis & Birmingham, Kansas City, Springfield & Memphis, Louisville & Nashville, Louisville, New Orleans & Texas, Memphis & Charleston, Memphis & Little Rock, Mississippi & Tennessee and Newport News & Mississippi Valley. The officers for the present year are M. Burke (Mississippi & Tennessee), President; R. B. Pegram (Memphis & Charleston), Vice-President; A. Gordon Jones (Memphis & Little Rock), Secretary.

PERSONAL.

Darwin Kenyon, freight agent of the Lake Shore & Michigan Southern in Buffalo, N. Y., died on Dec. 28, aged 62 years.

John F. Prescott, of New London, Conn., for many years employed on the New London Northern, was last week presented with a purse of \$300, subscribed by officers and employes of the company. Mr. Prescott has been in the railroad business for 47 years.

Mr. Porter King, the veteran Boston & Albany engineer, who has run on that road 43 years, never until this week ran over and killed anybody with his steed. Monday evening his engine killed a man in the West Springfield yard, but Mr. King was not in the least to blame, the man stepping right in front of the pilot.—Springfield (Mass.) Homestead.

John F. Anderson, a prominent citizen of Portland, Me., died of heart disease on Dec. 25. He was 64 years old. After receiving an academic education he became a civil engineer and was a tache to the Northeastern Boundary Commission. He was employed on the line of the old York & Cumberland, the Androscoggin & Kennebec, and as Chief Engineer of the Portland & Ogdensburg. He has also been Chairman of the Board of Railroad Commissioners of Maine for several terms.

ELECTIONS AND APPOINTMENTS.

Buffalo, Rochester & Pittsburgh.—W. H. Griffith has been appointed Chief Train Dispatcher, vice J. C. Hyde, resigned. Appointment takes effect Feb. 1.

Choctaw Railroad & Coal Co.—The officers of this company are: Geo. B. Kirkbride, President; J. A. Wolverton, Vice-President; Arthur M. Keith, Secretary and Treasurer.

Colorado Midland.—T. R. Gabel has been appointed Fuel Agent, with office at Colorado Springs, Col.

Eastern.—The five newly-elected directors met last week and elected Gen. Samuel C. Lawrence President pro tem.

Fremont, Elkhorn & Missouri Valley.—G. F. Wheelock has been appointed General Agent of the road at Sioux City, Ia. H. Cassidy has been appointed Assistant General Freight Agent.

Galveston & Western.—The incorporators of this Texas company are W. Hinchman, T. F. H. Meyer, B. W. Throck er, T. W. Dodd, John Pratt and others.

Gulf, Colorado & Santa Fe.—Wharton J. Terry, of Galveston, Tex., has been appointed attorney for this company.

Hartford & Connecticut Western.—Officers were re-elected last week as follows: President, James W. Husted; Vice-President, William H. Barnum; General Superintendent, Edwin McNeill; Secretary and Treasurer, E. R. Beardsley; Executive Committee, Messrs. W. H. Barnum, H. A. Botsford, W. W. Gibbs and Frederick Miles.

Indianapolis, Decatur & Western.—The first board of directors are: John D. Probst, of New Jersey; Hiram Hitchcock, Henry D. Hammond, Horace L. Hotchkiss, Stephen H. Thayer, Charles H. Allen, and Thomas B. Atkins, of New York; John K. Warren and E. F. Leonard, of Illinois; and John R. Elder and R. B. F. Pierce, of Indiana.

Long Beach, Whittier & Los Angeles.—The incorporators of this California company are Leland Stanford, Charles F. Crocker, Timothy Hopkins, W. V. Huntington and W. E. Brown.

Memphis Superintendents' Association.—The officers of this association, formed by the roads centering in Memphis, Tenn., are: President, M. Burke (Memphis & Tennessee); Vice-President, R. B. Peggam (Memphis & Charleston); Secretary, A. Gordon Jones (Memphis & Little Rock).

Mobile & Ohio.—James C. Clarke has been appointed General Manager.

New York, Lake Erie & Western.—George E. Allen has been appointed General Northern Passenger Agent, headquarters at Buffalo.

G. W. Conklin has been appointed Trainmaster of the Susquehanna Division vice C. V. Merrick, promoted.

Princeton, Marion & Ohio.—This company, which was incorporated in 1872, has been organized with J. W. Blue, of Marion, Ky., as President, and J. G. Rochester, Secretary.

Rhode Island Railroad Commission.—James H. Anderson has been appointed Commissioner in place of Walter R. Stiness. Mr. Anderson has for 12 years been in the service of the New York, Providence & Boston.

Rome, Watertown & Ogdensburg.—At the annual meeting this week the following officers were elected: Charles Parsons, Clarence S. Day, Edwin Parsons, William Lummis, George Parsons, Charles Parsons, Jr., and J. Q. A. Johnson, of New York; John S. Farlow, of Boston; William M. White, J. F. Maynard, John Thorn and J. M. Crouse, of Utica, and Walton Ferguson, of Stamford, Conn. The directors re-elected Charles Parsons President, Clarence S. Day and Charles Parsons, Jr., Vice-Presidents, and J. A. Lawler Secretary and Treasurer.

J. S. Emery has been appointed General Agent, with headquarters in Rochester.

Romey & Short Mountain.—The incorporators of this West Virginia company are: C. S. White, Isaac T. Brady, S. L. Flourney, R. W. Gilkeson and R. W. Daily, of Romey, and Robert W. Monroe, of Kingwood, W. Va.

Rumford Falls & Buckfield.—At the meeting in Portland, Me., last week, the following directors and officers were elected: W. L. Putnam, Portland; C. R. Millikin, Portland; W. H. Moulton, Portland; George C. Wing, Auburn; George D. Bisbee, Buckfield; Otis Hayford, Canton; R. C. Bradford, Portland. President, W. L. Putnam; Vice-President, Otis Hayford; Superintendent, L. L. Lincoln; Clerk and Treasurer, O. Bradford.

Union Pacific.—The following Traveling Passenger Agents have been appointed: J. B. Frawley, with headquarters at Omaha, Neb.; A. T. Sherwood, at Cleveland, O.; E. M. Ford, at Des Moines, Ia.

OLD AND NEW ROADS.

Allegheny Valley.—The Court has authorized the company to pay the semi-annual interest falling due Jan. 1, on \$4,000,000 of bonds, amounting to \$146,000, and also to pay the residue of the interest, which fell due Oct. 1, 1887, on \$18,000,000 of bonds, amounting to \$100,000.

Atchison, Topeka & Santa Fe.—The Great Bend (Kan.) extension from Modoc to the west line of Wichita County, a distance of 27 miles, was opened this week. This line is being pushed to Colorado Springs. It is parallel to the Missouri Pacific's Pueblo extension and at Colorado Springs will connect with the Colorado Midland, which is completed from that point through Leadville to Aspen and which is eventually to be extended to Salt Lake City.

The grading on the Los Angeles & Santa Ana in California is completed from Santa Ana through Orange, Anaheim and Fullerton. It will be finished to Los Angeles by Jan. 15. On the completion of this branch through Los Angeles and San Diego trains will run over it. It will be the short route to San Diego via Santa Ana.

The company has laid 1,361 miles of track since Jan. 1, 1887, distributed as follows: Great Bend extension, Ness City to Crosby, 100 miles; Augusta Extension, Augusta to Mulvane, 21 miles; Mulvane Extension, Spivey to eastern line of Clark County, 87 miles; Southern Kansas & Panhandle Road, eastern line of Clark County to Englewood, 28 miles; Colony Extension, Neosho Falls to Yates Centre, 14 miles; Eldon Extension, Gladstone to Bazar, 7 miles; Arkansas Extension, Mendota to Purcell, 99 miles; Iarned Extension, Burdett to Jetmore, 28 miles; Benedict Extension, Colville to Madison, 29 miles; Kiowa Extension, Alva to Indian Ter., and Iowa state line, 103 miles; Southern Kansas Railway, of Texas, Indian Ter. and Texas state line to Panhandle City, 114 miles; Southern Kansas road, Frontenac Extension, 7 miles; Burlington Extension, Burlington to Gridley, 11 miles; Strong City Extension, Strong City to Miltonvale, 103 miles; Manchester to Barnard, 43 miles; Abilene to Salina, 22 miles; St. Joseph & Santa Fe Railroad, Atchison to St. Joseph, 21 miles; Leavenworth, North & South, Hawthorne to Wilder, 46 miles; Clelland Extension, Clelland to Canon City, 10 miles; Denver & Santa Fe, Pueblo to Denver, 117 miles; Chicago, Santa Fe & California, Kansas City to Ancona, Ill., 358 miles.

Austin & McGregor.—The company filed articles of incorporation last week. A road will be built from Austin, Tex., to McGregor in McClellan County, 85 miles.

Buffalo, Rochester & Pittsburgh.—The company is asking bids for 600 coal cars.

Canadian Pacific.—The draw span of the International Bridge at the Sault Ste. Marie was swung into position on Dec. 28. Track is laid to the bridge. The town of Sault Ste. Marie, Ont., voted \$20,000 to the railroad company on condition that shops be built there.

Three steel steamers, to be built on the Clyde, have been contracted for by this company. They will be of 3,000 tons burden, and will be used between the western terminus of the road and Japan.

Cape Girardeau & Southwestern.—The line is being located from Wappapello, Stoddard County, Mo., to Lee, in Carter County.

Central Iowa.—This road will be taken out of the hands of J. H. Dudley, the Receiver, in February, and the name changed to the Iowa Railway Co. The road runs from Lyle to Albia, Ia., and from Oskaloosa to Peoria, Ill., and with its branches and leased lines has 518 miles of track.

Charleston, Cincinnati & Chicago.—George Potts, of Aiken, S. C., has the contract for building 25 miles of this road from Aiken to Edgefield.

Chesapeake & Ohio.—The judgment of C. P. Huntington against this company for \$1,765,000 was recorded in Wayne County, W. Va., last week.

Chicago & Eastern Illinois.—The company has filed for record the resolutions authorizing the issue of first mortgage general consolidated bonds to the amount of \$8,000,000 for the purpose of funding, exchanging or paying off existing bonds. The new mortgage will be in favor of the Central Trust Co., of New York.

Chicago, Jefferson City & El Paso.—Enough aid has been voted to this company to secure the building of the road from Girard, Kan., to Jefferson City, Mo., a distance of 180 miles. Work on the grading will begin early in March.

Chicago, Milwaukee & St. Paul.—The company has completed a survey between Wausau and Winneconne, Wis., and will build the road early next season.

Chicago & Northwestern.—The company is having a survey made across the Sioux Reservation in Dakota. Eight years ago the survey for the same line was made, and the notes and profile were stolen.

Chicago, Rock Island & Pacific.—The business men of Denver, Col., have petitioned the company to make that city its western terminus. The company had decided on Colorado Springs.

Chicago, Santa Fe & California.—It is announced that there will be some little delay in opening this road. The management now hopes to open it about Feb. 1, but it is likely to be the first of March before it is got into working order.

Choctaw Railroad & Coal Co.—This company was recently incorporated for the purpose of developing coal lands in Indian Territory. The general office is in Minneapolis, Minn.

Cincinnati & Richmond.—This branch of the Pittsburgh, Cincinnati & St. Louis between Hamilton and Red Bank, O., is nearly completed, and will be ready for trains by the latter part of next month.

Cincinnati Southern.—A branch to Burlington, Ky., 6 miles from the main line, will probably be built.

Columbus, Hocking Valley & Toledo.—In the suit brought by President Shaw of this company against Judge Burke *et al.*, Judge Evans of Ohio made an important decision. An injunction had been previously allowed restraining Judge Burke from disposing of \$8,000,000 of stock alleged by the railroad company to have been fraudulently received. The Court overruled a motion to dissolve the injunction. It was found from the evidence that in 1881 Judge Burke and associates bought all the capital stock of the railroad company, elected themselves directors thereof, and issued its negotiable mortgage bonds for \$8,000,000 payable in 50 years; and that they used these bonds to purchase from a majority of themselves and from other parties the entire capital stock of a coal company to the value of about \$800,000. Judge Evans holds this transaction void. Judge Burke gives notice that a bill of exception to the rulings will be presented in the prescribed time.

Denver, Utah & Pacific.—The shops at Denver, Col., were wrecked by a boiler explosion last week. The loss was \$90,000.

Duluth, Rainy Lake & Southwestern.—The company has petitioned Congress for permission to build this road through Indian reservations and unsurveyed land in Minnesota, with the right to bridge Red River. The road is intended to run from Duluth, Minn., northwestward to Rainy Lake, thence westward through the Red Lake Reservation into Dakota.

Eastern.—A bill in equity was last week filed by Dwight Braman against A. D. Foster and others, to restrain the directors, declared to be elected at the recent annual meeting, from exercising the functions of their office until the legality of the election can be determined by the Court. Judge Devens, of the Supreme Court, issued an order restraining Messrs. Cobb, Simes, Heywood and Peabody from acting as directors.

It is stated that the trouble among the stockholders has been settled by a compromise. An agreement has been reached by which Dwight Braman will go on the board and he and his friends will have six out of nine members. The adjourned meeting will take place this week.

Evansville, Suburban & Newburg.—This company has been incorporated at Evansville, Ind., with a capital stock of \$50,000.

Fremont, Elkhorn & Missouri Valley.—The Omaha line has been opened from Arlington to Omaha, Neb., together with a branch from Irvington to the South Omaha stock yards.

Flint & Pere Marquette.—The company has contracted for a new freight steamer for the Milwaukee and Ludington route, on Lake Michigan, to cost \$75,000.

Galveston & Western.—The company has been chartered in Galveston, Tex., with a capital stock of \$200,000.

Georgia Pacific.—The company has contracted for 400 new box, coal and flat cars for use on the road from Atlanta to Columbus, Miss. Four new 10-wheel freight locomotives have also been ordered.

Georgia Southern & Florida.—Ten miles of track are completed from Macon, Ga.

Grafton Centre.—A survey was begun last week upon an extension of the road from Grafton Centre, Mass., through West Upton and Hopedale to the Milford branch of the New York & New England, near South Milford. The road, which was recently made standard gauge, forms a link in the proposed route from Worcester to Boston via Milford and the New York & New England. It connects with the Boston & Albany at North Grafton.

Grand Trunk.—It is announced that the transfer of the Northern & Northwestern road to this company has been practically completed.

Hudson Suspension Bridge & New England.—The stockholders will meet on Jan. 16 to authorize an issue of first mortgage bonds to the amount of \$10,000,000.

Illinois Central.—It is reported that the company has decided to build an independent outlet to St. Louis next spring. The extension is to leave the main line at Edge-wood, Ill., running westward via Logansport, Shabonier, Jamestown and Caseyville direct to East St. Louis. The company has thus far been dependent on the Vandalia for a St. Louis outlet. About 75 miles of new road will have to be built to complete an independent line from Chicago to St. Louis.

The surveyors are now at work on the line to be built to Memphis, Tenn.

Indianapolis, Decatur & Western.—The Indianapolis, Quincy & Mississippi, of Illinois, and the Indianapolis & Wabash, of Indiana, filed articles of consolidation in Illinois this week under the above name. The purpose is to operate the lines of the Indianapolis, Decatur & Springfield. Capital stock, \$1,000,000. Principal offices, Indianapolis and Springfield.

Indianapolis & Vincennes.—The company contemplates building a branch from Spencer to Patricksburg, Owen County, Ill., to reach valuable coal deposits.

Kansas City & Southwestern.—This branch of the Missouri Pacific is to be opened for business this week. It extends from Kansas City, Mo., to Paola, Kan., 50 miles.

Kildare & Linden.—The survey for this road from Kildare to Linden, Tex., has been completed, and work will commence at once.

Knoxville, Carolina & Western.—Greenville County, S. C., has voted a subscription of \$200,000 to the stock of this company. This, with the \$400,000 previously subscribed by Knox and Sevier counties, in Tennessee, and Haywood and Transylvania counties, in North Carolina, completes the sum required to finish the road from Knoxville, Tenn., to Port Royal, S. C., and this is to be done within 18 months.

Lake Shore & Michigan Southern.—The company has ordered 300 new coal cars and 24 new locomotives.

Lincoln, Red Oak & Des Moines.—The city of Lincoln, Neb., has voted a subscription of \$150,000 bonds for 20 years, at 5 per cent., in aid of this company. The bonds are granted only upon the completion of the road. The road is expected to be built from Lincoln to a connection with the Diagonal Line, near Des Moines, Iowa.

Long Beach, Whittier & Los Angeles.—Articles of incorporation have been filed by this company in California. The road is to be six miles long, running from Los Angeles to Whittier. The contract has been let to the Pacific Improvement Co. The citizens of Whittier have subscribed \$200,000 to the enterprise. The capital stock is \$1,500,000.

McKeesport & Bellevue.—It is stated that the company will build a branch between Elizabeth and McKeesport, Pa., a distance of 7 miles.

Merrill & Abbottsford.—This road will be built next season from Abbottsford to Wausau and Merrill, Wis. E. B. Greenleaf, of New York, is the contractor.

Mexican Central.—Track is laid for 62 miles on the Guadalajara branch, and grading is completed for 21 miles more.

Milwaukee, Peoria & St. Louis.—Thomas S. King, a New York contractor, is examining the ground, and says that plans of this company will be carried out next summer. The company was formed in December, 1885, by the consolidation of the Milwaukee & Dubuque road of Wisconsin and the Bureau & Northwestern, of Illinois. The purpose of the consolidated company was to build a line from Milwaukee, Wis., southwest to Peoria, Ill., and thence, either by new construction or by arrangement with existing roads, to reach St. Louis. J. R. Robinson, of New York, is Chief Engineer.

Missouri Pacific.—It is stated that the Jewel City branch will be extended in the spring northwest from Burr Oak, Kan., its present terminus, to Salem, Red Cloud and Kearney.

Nashville & Knoxville.—After a partial suspension work is to begin again all along the line of this road. Immediately after the failure of the late contractors, the unfinished work for 14 miles east of Lebanon, Tenn., was relet to Davis & Canty, of Nashville. The remainder of the road to Carthage and to the Caney Fork River was relet to Shaffer, Coffey & Co., of St. Louis, Mo. President A. L. Crawford is now closing a contract for all the bridges between Carthage and Lebanon.

New York & Harlem.—Negotiations between the officials of the railroad company and owners of property along the route regarding the sinking of the tracks in the annexed district of New York are now progressing and contracts leading up to a settlement are being formulated. But no settlement has yet been reached, as was erroneously stated in the daily papers. Work is likely to begin, however, in the spring.

Niagara Central.—Grading is completed from Thorold to St. Catharines, Ont., and track will be laid in the spring.

Norfolk & Western.—It is stated that the company intends building a belt road around Lynchburg, Va. Next year the company expects to build iron bridges across the Elizabeth River and its eastern and southern branches.

Northeastern (Georgia).—It is stated that the road will be extended from Tallulah, Ga., to Knoxville, Tenn.

Ohio Valley.—The company purposes to extend its road from Henderson, Ky., to Evansville, Ind., making the latter city its northern terminus.

Oxford & New Glasgow.—The following firms have been awarded contracts for building 50 miles of this road: Sections 1 and 3, J. O'Brien, of Renfrew, Ont., and Thomas Cooke, of Oxford, N. S.; Section 2, D. M. Sutherland, of Shubenacadie, N. S.; Section 4, Archie Stewart and Ralph Jones, of Ottawa.

Pacific in Nebraska.—The company has just completed the line from Warlick, Kan., to Lawrence, Neb., 35 miles.

Pacific Railway.—The company filed articles of incorporation in Nebraska. The proposed road will start from a point on the south side of Hall County and run northwestward to the western line of Nebraska. It is believed to be an extension of the Hastings branch of the Missouri Pacific.

Panhandle.—Chartered in Texas to build a road from Washburn to Panhandle City, 25 miles. Directors of the Fort Worth & Denver City are among the incorporators.

Pennsylvania.—It is rumored that the company has bought 400 acres of land along its road between Grapevins

and Rodebaugh, in Westmoreland County, Pa., and that shops will be built on it.

The case of this company against the Allegheny Valley to secure a foreclosure of mortgage held by the former in order to have a sale of the road, has been postponed. The case involves several million dollars.

Philadelphia & Reading.—During the past week a strike among the employees of this company, ordered from Port Richmond, has dwindled from the most stupendous proportions to nothing, and the committee of Knights of Labor who had charge of the suicidal action have made a complete backdown and unconditional surrender. The men returned to work on Dec. 27. The railroad company made no concessions to the strikers. The new men who were taken on to replace strikers will be retained. The leaders at Port Richmond who ordered the strike have been discharged, and will not be allowed again in the company's service. Taken together it was a complete victory for the railroad company, and cast a doubt on the alleged infallible power of a Knights of Labor union over its subjects. About 2,500 men in Reading refused to obey the order to strike.

Pittsburgh, Cincinnati & St. Louis.—The company will immediately extend its New Cumberland (W. Va.) branch for a distance of 3 miles.

Pittsburgh & Western.—The company has ordered 1,000 coal cars.

Quincy, Missouri & Pacific.—It is stated that the road is to be extended from Trenton, Mo., to St. Joseph, a distance of 75 miles.

Rome & Sylvan Beach.—The survey of this road from Rome, N. Y., to Sylvan Beach, Oneida Lake, was begun this week. The road is to be finished by July 1. D. C. Hadcock, of Syracuse, is managing the enterprise.

Romney & Short Mountain.—This company has been chartered at Kingwood, W. Va., to build a narrow gauge road.

St. Louis, Kansas City & Colorado.—This company has filed maps and profiles for two lines, one to run from St. Louis to Fort Scott, and another by way of Sedalia to Kansas City, Mo. The contracts for building will be let in January.

St. Louis & San Francisco.—The road is completed into Ellsworth, Kan. The depot and roundhouse there are completed and work on the machine shops will begin at once.

Tennessee & Coosa.—The company will hold a meeting on Jan. 16, to consider increasing its capital stock from \$500,000 to \$666,666 and the bonds from \$10,000 to \$20,000 per mile.

Toledo, Ann Arbor & Cadillac.—This road from Mt. Pleasant to Cadillac, Mich., 69 miles, was opened for traffic this week.

Upper Coos.—This road, 23 miles long, and running from North Stratford to West Stewartstown, N. H., was opened for business on Dec. 26.

Vincennes, Oakland City & Owensboro.—The survey is completed to Lynnville, Warrick County, Ind., 31 miles from the Ohio River, and will be continued to Oakland City and Vincennes.

Virginia.—Bills have been introduced in the Virginia Legislature to incorporate the Bristol & South Atlantic Railroad Company, the Petersburg & Asylum and the Great Southern. The latter wishes to build a road from Norfolk to Bristol, and among the incorporators are John Neely, H. L. Turner, J. F. Crocker and M. C. Henry.

Wabash.—Receiver McNulta has just finished his report of the receipts and disbursements for the month of November. The balance on hand, Oct. 31 was \$910,457; receipts during the month, \$853,207; total, \$1,763,664. The disbursements on accounts prior to April 1, 1887, were \$17,477; on current account, \$792,515; deposit for payment of coupons on first mortgage bonds, \$187,471; total, \$997,464. Balance on hand, Nov. 30, \$766,200.

The summary of receipts and disbursements from Jan. 1 to Nov. 30 is as follows:

Receipts.	
From operation of road	\$8,611,835
Disbursements.	
Operation of road	\$6,307,620
Track rentals	153,319
New York & Pacific Car Trust Association, interest and expenses	118,835
Chicago & Western Indiana Railroad Sinking Fund	22,081
Taxes, 1888	208,123
Taxes, 1887	2,925
Special taxes	7,611
Interest on first mortgage bonds	1,025,119
	\$7,845,635

Balance cash on hand Nov. 30, 1887, \$766,200

It is understood that the line of steamers belonging to this company will again be placed on Lake Erie between Toledo and Buffalo next season.

West Jersey.—The stockholders of the Swedesboro road have unanimously agreed to merge and consolidate with the above company. This merger completes the consolidation with the West Jersey of the following six roads: Salem Branch, Swedesboro, Woodstown & Swedesboro, West Jersey, Terminal and Maurice River.

Western New York & Pennsylvania.—The company's round house, at Oil City, Pa., containing seven locomotives, was burned last week. The company will be crippled for engines, as there were not enough before these were burned.

The company filed last week in Mercer County, Pa., two mortgages, each for \$10,000,000, one in favor of the Mercantile Trust Co., and the other to the Fidelity Insurance Trust & Safe Deposit Co., of New York.

Wheeling & Harrisburg.—On Feb. 4, the people of Ohio County, W. Va., will vote on the question of subscribing \$300,000 in aid of this enterprise. The company has closed a contract with Heman Clark, of New York, for the construction of a tunnel and terminals in Wheeling, a bridge across the Ohio and 41 miles of road between Wheeling and Bowerstown, O. The county's subscription is contingent upon the work being undertaken. Work to begin within eight months.

Williamsport & Binghamton.—This company, reported last week, intends building a road from Williamsport, Pa., to Binghamton, N. Y., a distance of 90 miles.

TRAFFIC AND EARNINGS.

Railroad Earnings.

Earnings of railroad lines for various periods are reported as follows:

Month of November:		1887.	1886.	Inc. or Dec.	P. c.
Chl. St. L. & P.	494,217	436,202	I.	58,015	13.5
Net	100,674	100,501	I.	172	1
Cleve. & Cant.	33,682	31,292	I.	2,390	7.6
Net	11,138	5,298	I.	5,840	110.1
Mexican Central	453,800	397,902	I.	73,898	19.4
Net	191,800	176,529	I.	15,271	8.6
Nash., C. & St. L.	259,605	213,769	I.	45,836	21.4
Net	109,905	91,272	I.	18,633	20.4
Norfolk & West.	410,211	337,709	I.	72,502	21.4
Net	178,392	132,683	I.	45,699	34.4
Northern Central	542,158	493,150	I.	49,008	9.9
Net	102,177	197,916	D.	95,749	48.8
Petersburg	31,404	28,300	I.	3,104	10.9
Net	10,761	7,674	I.	3,087	40.2
Rich. & Peterb.	30,176	17,382	I.	12,794	73.7
Net	8,857	8,166	I.	691	8.4
Chic. & N. W.	2,650,100	2,362,693	I.	287,407	12.1
Illinois Central	1,328,726	1,194,180	I.	134,546	11.3
Ced. F. & Min.	10,540	15,892	D.	5,352	33.6
Dub. & S. City	82,335	84,855	D.	2,520	3.0
La. F. & S. C.	67,128	54,843	I.	12,285	21.0
N. Y., Sus. & W.	129,904	107,735	I.	22,169	20.5
Petersburg	31,404	28,300	I.	3,104	10.9
Rich. & Peterb.	20,175	17,382	I.	2,793	16.1
South Carolina	119,674	113,609	I.	6,065	5.3
Valley (Ohio)	56,793	61,106	D.	4,313	7.0

Month of October:		1887.	1886.	Inc. or Dec.	P. c.
C. I. St. L. & C.	242,173	247,953	D.	5,780	2.3
Net	99,570	99,617	D.	47	0.0
E. Ten., Va. & G.	555,212	456,017	I.	99,195	21.6
Net	221,834	244,309	D.	22,475	9.1
M. St. Ste. M. & A.	22,084	10,358	I.	11,726	103.1
Net	6,374	6,132	I.	242	3.9

Ten months—Jan. 1 to Oct. 31:		1887.	1886.	Inc. or Dec.	P. c.
C. I. St. L. & C.	2,335,005	2,146,157	I.	188,848	8.7
Net	873,609	840,656	I.	32,953	3.9
E. Ten., Va. & G.	4,310,560	3,438,230	I.	872,330	25.3
Net	1,251,718	1,171,701	I.	80,017	6.8

Eleven months—Jan. 1 to Nov. 30:		1887.	1886.	Inc. or Dec.	P. c.
Chl. St. L. & P.	5,284,753	4,372,892	I.	911,861	20.8
Net	1,368,305	747,488	I.	620,817	83.0
Cleve. & Cant.	345,161	327,719	I.	17,442	5.3
Net	101,131	71,445	I.	29,686	41.5
Mexican Cen.	4,332,935	3,416,723	I.	916,212	26.7
Net	1,808,336	1,172,702	I.	635,634	53.3
Nash., C. & St. L.	2,780,435	2,170,826	I.	609,609	28.0
Net	3,848,396	2,984,725	I.	863,671	28.9
Net	1,588,955	1,200,136	I.	388,819	32.3
Net	1,241,978	873,475	I.	368,503	42.1
North. Central	5,712,641	5,116,808	I.	595,833	11.6
Net	1,883,673	1,708,445	I.	175,228	10.2

Year to Sept. 30:		1887.	1886.	Inc. or Dec.	P. c.
Boston & Maine	8,192,382	7,543,690	I.	648,692	8.5
Net	3,245,766	3,001,083	I.	244,683	8.1
Rost. & Prov.	1,905,496	1,784,805	I.	120,691	6.7
Net	470,804	399,879	I.	70,925	17.7
Buf. Roch. & P.	1,830,401	772,294	I.	1,058,107	137.1
Net	550,392	180,848	I.	369,544	204.3
Cheraw & Darl.	76,024	81,134	D.	5,110	6.3
Net	28,788	33,791	D.	5,003	17.3
Cher. & Salis.	10,557	21,022	D.	10,465	21.2
Net	640	7,028	D.	6,388	91.9
Conn. River	939,742	880,344	I.	59,398	6.7
Net	229,307	234,756	D.	5,449	2.3
Del., Lacka. & W.	6,568,232	5,646,179	I.	922,053	16.3
Net	3,700,825	3,314,796	I.	386,029	11.6
Hart. & Cona W.	340,484	348,865	D.	8,381	2.4
Net	108,796	101,306	I.	7,490	7.4
Lake S. & M. So.	18,101,050	15,231,457	I.	2,869,593	17.6
Net	8,125,368	6,340,458	I.	1,784,910	28.1
Maine Central	3,151,277	3,008,476	I.	142,801	4.7
Net	1,202,707	1,187,736	I.	15,001	1.2
Nauvauk	725,628	704,336	I.	21,292	3.0
Net	240,064	221,513	I.	18,551	8.4
N. Y. C. & H. R.	35,297,523	30,242,363	I.	5,055,160	16.7
Net	12,908,432	11,895,984	I.	1,012,448	8.5
N. Y. City & No.	484,380	523,351	D.	38,971	7.4
Net	65,731	111,076	D.	45,345	69.4
N. Y., L. E. & W.	19,882,071	18,310,495	I.	1,571,576	8.5
Net	6,701,390	6,031,088	I.	670,302	11.1
N. Y., P. & Ohio	6,395,127	6,161,107	I.	234,020	3.8
Net	2,155,126	3,051,875	D.	896,749	41.2
N. Y., Ont. & W.	1,492,851	1,492,851	I.	0	0.0
Net	245,608	221,900	I.	23,708	10.7
North. Cn. (S. C.)	534,253	558,634	D.	24,381	4.5
Net	150,834	121,765	I.	29,069	23.9
Old Colony	4,865,571	4,528,032	I.	337,539	7.4
Net	1,587,980	1,537,325	I.	50,655	3.2
Prov. & Worces.	1,270,828	1,245,711	I.	25,117	2.0
Net	438,977	371,050	I.	67,927	18.3
Rt. & Alleg.	615,859	597,045	I.	18,814	3.1
Net	157,898	158,098	D.	199	0.1
St. L. & San F.	6,250,000	4,874,122	I.	1,375,878	28.2
Net	3,350,000	2,652,332	I.	697,668	26.3
Total (gross)	118,953,171	104,820,420	I.	14,132,751	13.4
Total (net)	55,081,210	50,170,986	I.	4,910,224	9.8
Net			I.	5,504,224	10.9

Early reports of monthly earnings are usually estimated in part, and are subject to correction by later statements.

Cotton.

The cotton movement for the week ending Dec. 28 is reported as below, in bales:

Interior markets:		1887.	1886.	Inc. or Dec.	P. c.
Receipts	141,225	180,931	D.	39,706	21.9
Shipments	131,916	158,350	D.	26,434	14.7
Stock	503,678	433,534	I.	70,144	16.1
Exports:		1887.	1886.	Inc. or Dec.	P. c.
Receipts	202,859	283,045	D.	80,186	28.3
Exports	133,614	229,198	D.	95,584	71.6
Stock	1,039,257	1,060,973	D.	21,716	2.0

Coal.

The coal tonnages for the week ending Dec. 24 are reported as follows:

Coal.		1887.	1886.	Inc. or Dec.	P. c.
Anthracite	678,141	578,959	I.	99,182	16.7
Bituminous	303,153	290,289	I.	12,864	4.4

The coal tonnages of the Pennsylvania road for the week ending Dec. 24 are reported as follows:

Coal.		1887.	1886.	Inc. or Dec.	P. c.
Line of road	249,711	83,606	I.	166,105	198.3
Year to date	10,219,717	3,605,890	I.	6,613,827	183.4
Year 1886 to same date	8,570,946	3,483,621	I.	5,087,325	146.1

Illinois Rates.

The leading Chicago roads reduced their rates, both to local stations and to Missouri River points, on Dec. 20, as had been announced, but the printed tariffs had not been completed, and it therefore appears that the exact figures to local stations were not announced. The Chicago & Alton, which had protested against the reduction of local rates, notified its patrons that it would take all freight between Chicago and St. Louis at 10 per cent. below the rates of any other road. Press dispatches intimate that the Illinois Central and Wabash will meet the Alton's rates, and that this action will be followed by a further reduction on the part of the latter;

but there seems to be very little information as to the exact rates charged on actual shipments over any road.

The reduction between Chicago and Lincoln, Neb., is 20 per cent., the new rates being on the basis of 80 cents, first-class. Between St. Louis and Lincoln the new rates are on the basis of 60 cents, first-class.

Traffic Notes.

A Richmond (Va.) dispatch states that a shipment of 30 carloads of dry goods from New York for St. Paul, Minn., passed over the Newport News & Mississippi Valley on Dec. 27.

General Manager Hickson, of the Grand Trunk, states that the earnings of his road from through traffic to and from the United States are \$4,000,000 a year.

ANNUAL REPORTS.

Northeastern (South Carolina).

The company owns a line from Charleston, S. C., to Florence, 102 miles. The report is for the year ending Sept. 30.

The earnings for the year were as follows:

		1887.	1886.	Inc. or Dec.	P. c.
Earnings	\$554,253	\$558,634	D.	\$4,381	0.8
Expenses	394,419	436,869	D.	42,450	9.7
Net earnings	\$159,834	\$121,765	I.	\$38,069	31.2
Gross earn. per mile	5,434	5,477	D.	43	0.8
Net " "	1,567	1,194	I.	373	31.2
P. c. exps. to earn	71.2	78.2	D.	7.0	9.0

The equipment was 24 locomotives, 14 passenger, 8 baggage, mail and express, and 316 freight and other cars.

The general balance sheet, condensed, is as follows:

Liabilities :		
Capital stock		\$900,000
Funded debt		1,836,025
Balances		101,129
Profit and loss		102,137
		<u>\$2,939,291</u>
Assets :		
Road and equipment		\$2,264,761
Terminal improvements		235,182
Real estate		10,812
Stock and bonds		169,156
Cash and cash items		259,380
		<u>\$2,939,291</u>

